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BULLETIN of the INSTITUTE of the HISTORY OF MEDICINE

THE JOHNS HOPKINS UNIVERSITY

Editor—HENRY E. SIGERIST

VOLUME III MARCH, 1935 NUMBER 3

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THE JOHNS HOPKINS PRESS

BALTIMORE, MARYLAND

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Correspondence relating to the publication of papers should be addressed to The Editor, Bulletin of the Institute of the History of Medicine, 1900 East Monument Street, Baltimore, Maryland, U. S. A.

Twenty-five reprints without covers will be furnished to contributors free of cost. An order slip for additional reprints, giving the cost, is sent with the galley proof to each contributor and must be returned immediately to the Editor.

Correspondence pertaining to business affairs should be sent to the publishers, The Johns Hopkins Press, Baltimore, Maryland, U. S. A.

The journal is published monthly, except August and September. The volume will comprise about 500 pages.

Subscription is $5.00 a year in the United States and its possessions. In Canada $5.25 a year; in foreign countries $5.50 a year. Single numbers, when available, will be 75 cents each.

This journal will not publish book reviews.

Subscriptions may be entered at any time. However, if feasible and so desired by a subscriber, subscription may begin with the January number.

THE JOHNS HOPKINS PRESS

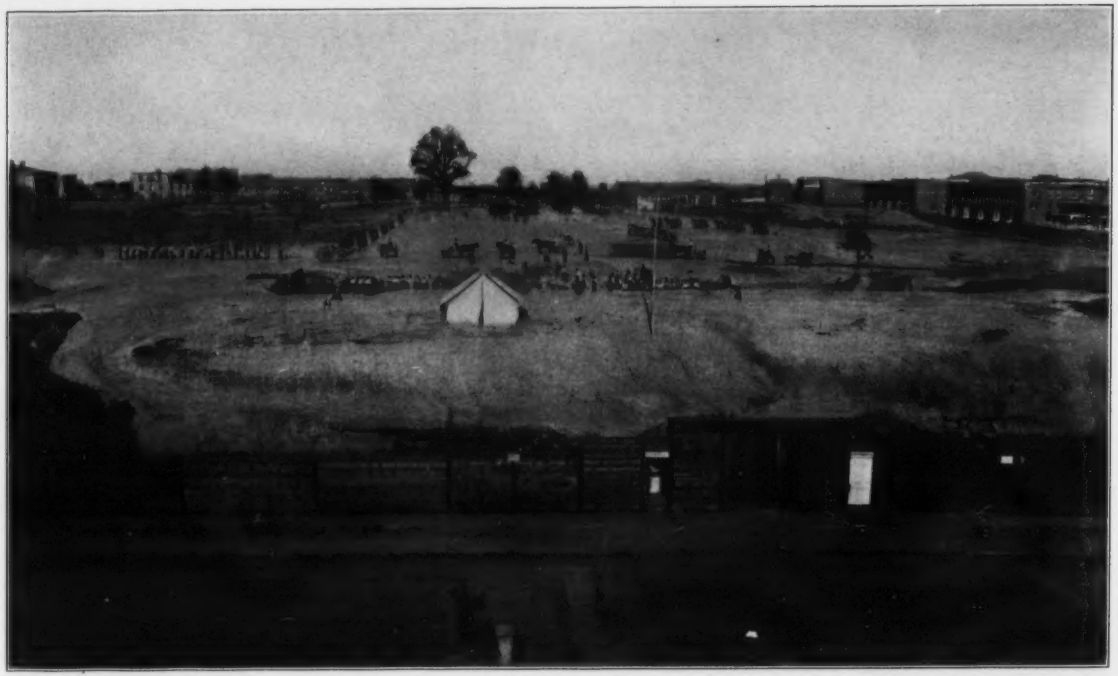
BALTIMORE, MARYLAND, U. S. A.

PUBLISHED TEN TIMES A YEAR

Made in United States of America

Entered as second-class matter January 3, 1935, at the post office at Baltimore, Maryland, under the Act of March 3, 1879.

OLD HOPKINS PICTURES No. 3



THE HOSPITAL GROUND BEING CLEARED IN 1877; VIEW FROM BROADWAY

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ASTROLOGY AND POLITICS IN THE FIRST YEARS OF ELIZABETH'S REIGN *

SANFORD V. LARKEY
University of California

In the past, astrological predictions have often influenced history, for not only have many monarchs based their actions on the advice of astrologers, but certain prophecies have so profoundly affected the state of mind of the public as to alter the course of events. Elizabeth of England was confronted by this danger in the early part of her reign, and the events of these years provide an excellent illustration of the part played by astrology in political history. Fortunately most of the documents have survived so that it is possible to reconstruct the complete picture — the predictions themselves, their effect on the public, and the efforts made either to suppress or to counteract them.

When Elizabeth ascended the throne of England in November 1558, the omens and portents were far from auspicious. There were few signs, celestial or mundane, that would indicate the long and successful reign that was to be her lot. As Camden has said, "England's affaires were at that time in a most miserable case, and lamentable state." Nor did the dire prophecies of the professional star-gazers add to her security, for they increased the fear and uncertainty of a people already torn by the bitterness and hatred of

* Read before the History of Science Society, in joint session with the American Historical Association, Washington, D. C., December 28, 1934.

religious strife. This was a very real danger in a time when most of the people, including leading scientists, believed in the validity of astrological prognostications.[1]

But one did not have to look to the heavens to be aware of the dangers confronting Elizabeth, for at home and abroad there were plots against her. Philip of Spain and Henry II of France were both anxious to aid the Catholic cause in England and it was only their fear of each other that prevented active intervention. Elizabeth took advantage of this situation with all the devious intrigues of diplomacy, and kept the support of Philip by holding before him the possibility of the impossible marriage. Elizabeth realized, however, that her greatest strength was the loyalty of her own people and that she must avoid anything that might increase dissension among them. The Religious Settlement was to be a compromise, and while this was being discussed in Parliament, she forbade any religious disputes or any actions that would excite the people. But there was still great confusion, which was aggravated by false rumours of all kinds, and particularly by astrological and other prophecies.

Many of these predictions had a very definite political significance, and they were made use of by the contending factions. Early in the reign, a plot on behalf of Mary Queen of Scots, said to have been instigated by the Guises, was uncovered and two members of the Pole family implicated. Conjurers had prognosticated that Elizabeth would not live a year, and that then Mary would come to the throne. Bishop Jewel, in a sermon before the Queen, voiced the popular fear of sorcery, particularly as it might affect Elizabeth herself,

> It may please your grace to understand, that this kind of people, I meane witches, and sorcerers, within these fewe last yeres, are marveilously increased within your graces realm. These eyes have seene most evident and manifest markes of their wickednesse . . .
>
> Wherefore, your poore subjects most humble petition unto your highnes is, that the lawes touching such malefactours may bee put in due execution.

---

[1] Robert Recorde and Leonard Digges, two of the most eminent scientists of the day, both believed in the influence of the stars on human affairs. See the preface to Recorde's *Castle of Knowledge* (1556), Sig. A_3^r, and Digges' *Prognostication everlastinge.*

For the schole of them is great, their doinges horible, their malice intollerable, the examples most miserable. And I pray GOD they never practise further than upon the subject.[2]

Prophecies had long been a factor in English politics.[3] There had been a law passed in the reign of Edward VI 'against fonde and fantasticall Prophesies' but this had now lapsed.[4] A similar bill was proposed at the Parliament of 1558-9 but was not passed. However the *Injunctions* of 1559, outlining the administration of the new religion, included a provision against sorcery.

32 Item, that no persons shall use charmes, sorcery, enchauntmentes, witchcraftes, south saying, or any such lyke devylyshe devyce, nor shall resort at any tyme to the same for counsell or helpe.

Another item in the *Injunctions,* No. 51, "agaynst heretical and sedicious bokes" was evidently invoked to curb the printing of certain prognostications.

When one reads the printed prognostications for 1559 it can readily be seen why they were a disturbing factor and why such laws were necessary. The effect on the populace of these prophecies has been told by William Fulke in his *Antiprognosticon,* 1560, a bitter attack on astrology, which because of its essentially rational attitude must be considered one of the important scientific works of the period.

The *Antiprognosticon* appeared first in a Latin version, naming on the title page prominent astrologers of the time. The full title is: *Antiprognosticon contra inutiles astrologorum predictiones Nostrodami, Cunninghami, Loui, Hilli, Vaghami, et reliquorum omnium.* It was printed by H. Sutton and H. Toy, dated the 6th of

[2] John Jewel, *Certaine Sermons* (London, 1583), "Luke 11, vers. 15." Also quoted by John Strype, *Annals of the Reformation* (Oxford, 1824), p. 11. In this and in the following quotations the original spelling and punctuation has been retained, except for lengthening of contractions, and modernizing of certain typographical features [s; v and u; i and j].

[3] R. Taylor, *The Political Prophecy in England* (Columbia Univ. Press, 1911), and M. H. Dodds, "Political Prophecies in the Reign of Henry VIII," *Modern Language Review,* XI, p. 277, discuss the influence of prophecies of the Merlin and Heraldic type, but have little to say of astrological prophecies. *The Mirror of Magistrates* has a number of historical references to the evil results of false prophecies.

[4] *Statutes of the Realm* (1819), 3 and 4. Edw. VI, ch. 15.

September. It was entered in the Stationers Register the 30th of August 1560. In the same year there was an English version, *Antiprognosticon that is to saye, an Invective agaynst the vayne and unprofitable predictions of the Astrologians as Nostrodame, etc. Translated out of Latine into Englishe,* printed by H. Sutton, with the colophon dated ' The 23. day of December.' Besides this translation of Fulke's treatise, by William Painter, the author of *The Palace of Pleasure,* the book also contained: *A shorte Treatise in Englyshe, as well for the utter subversion of that fained arte, as also for the better understandynge of the common people, unto whom the fyrst labour seemeth not sufficient,* by Fulke himself.[5] Both editions bear statements that the work has been allowed according to the Queen's Injunctions.

Fulke (1538-89) at the time of writing this book was a young man, about twenty-two, who had just taken his degree at St. John's College, Cambridge. Later he returned to the University, where he continued his studies in mathematics, languages, and theology, and became one of the leaders of the Puritan movement. Besides his religious works, the best known of which is his *A defense of translations of the holie scriptures into the English tong,* he wrote other scientific treatises. In 1563 he published *A goodly gallerye with a most pleasaunt prospect into the garden of natural contemplation,* on various phenomena in natural history, a work which went through a number of editions. He is credited with having put forth a prognostication himself, but as the only record of the existence of such a work is an entry in the Stationers Register, most likely this refers to the *Antiprognosticon.*[6]

Before discussing the contents of the *Antiprognosticon* with its description of the effect of the prognostications, let us see what it

[5] The author of this paper is at present preparing an edition of the English version of the *Antiprognosticon.*

[6] The entry in Arbers edition of the Stationers Register, vol. 1, p. 153, is as follows: "Recevyed of henry Sutton for his lycense for the pryntinge of [an] almanacke and pronostication of Fulke iiii d." while that on p. 205 is: "Recevyd of Edmonde hallay for his lycense for pryntinge of an almanack and pronostication of Fulkes authorysshed by my lorde of London vi d." As Sutton printed the *Antiprognosticon,* and as there is no other entry for the *Antiprognosticon,* it seems probable that these entries refer to that work.

was the astrologers said that provoked Fulke to pen this attack on them. On comparing the list of astrologers on the title page of the

VERA EFFIGIES DOCTISSIMI VIRI GULIELMI FULCONIS SS. THEOLOGIÆ PROFESSORIS OLIM in CANTABR. ACADEMIA AULÆ PENBROCHIANÆ CUSTODIS

WILLIAM FULKE
From the title page of *The Text of the New Testament* . . . ,
London, 1633

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Latin edition of Fulke with the known prognostications for the year 1559, as noted in Bosanquet,[7] it is seen that Fulke has included all

[7] E. F. Bosanquet, *English Printed Almanacks and Prognostications* (London,

the important writers of English prognostications for this particular period. Fortunately some of these have survived and from them we can obtain a very good idea of the tenor of them all. The Huntington Library has an apparently unique copy of Vaughan's *Almanacke and Prognostication for 1559,* printed by Thomas Marshe, in which Vaughan tells of the terrible events which will follow the eclipse of the moon and the evil conjunctions of the planets. Thus, the eclipse of the moon on 2 April, 1558, will have these results in 1559:

> The conjunction of Saturne and Mars in this Eclipse, sygnifieth dessencions, discordes, contencions, stryfe, great manslaughter, murmuracions, feares, and troubles shall happen to men, and no pytie nor mercy almost amongst men.[8]

> Also *Saturnus, Mars, Sol* and *Luna,* in *Tauro* decima domo, domus honoris, will not leave this yere without augmentinge of moche discorde and noughty enterprises, producinge descension, betwene the higher powers, and the lower or meaner sorte, betwene the spiritualty and the temporaltie, with moche pyllage, theftes, robberies, murmuracions, lyes, great noyses, tumultes, comocions, and suche oultrages.[9]

> The Figure of the heavens, at the time of the Eclipse of the Moone, 1559 . . . signifieth great mischiefe, discorde, manslaughter, hatred and wrath, aswel betwene great princes and ecclesyasticall persons, as the common people: aswel private as publike, with deceite, treason, theft, burnynge, adulterye, robborie, and finally all kind of wickednes. Also betwene secular riche and mighty princes, warre, envy, hatred, rancour, and deceite. Also the officers of great estate of some great prince shalbe deposed of their offyce, and shalbe greatlye hated of their prince.[10]

Cuningham's prognostication for 1559 is not known to be extant, although it was in existence about fifty years ago and was described in Notes and Queries (6th Series, XII, p. 204), but with no details of the prophecies. However his style is shown by his *Prognostication for the yeare 1564,* which is represented again in an apparently unique copy in the Huntington Library. Of the eclipse of the sun in 1563 he says:

1917), gives a detailed bibliographical description of the extant copies, and also a list of such works as have been mentioned by various authorities, copies of which seem not now to be extant. For a general discussion of astrology in Elizabethan England, see Carrol Camden, Jr., articles in *Library,* N. S., XII (1931), and in *Isis,* XIX (1930). However Camden has little on the works in question. It is significant that Fulke does not include in his list such really scientific writers of prognostications and tables as Leonard Digges, John Feild and John Dee.

[8] Sig. A_2^r. [9] Sig. $[A_3^r]$. [10] Sig. B_2^v-$[B_3^v]$.

For what els dothe the conglomoration and mustringe of so many planetes in the place of the Eclypse threten but warre, discention, malice, faire countenance and false trayterous hartes, and specially amonge the Popes genera-

MICHAEL NOSTRADAMUS
from the title page of *The True Prophecies*, 1672,
an English edition of *The Centuries*

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tion, aswel spirituall as temporal, also famine and greate tempestes on the Seas.[11]

The prognostications of Low and of Hill for this year exist only in fragments.

The prophecies that caused the greatest alarm in England were

[11] Sig. A_1^v.

those of Michael Nostradamus and it is significant that of all the astrologers listed on the title page of the Latin edition of Fulke, he is the only one mentioned on the title page of the English edition. Nostradamus had a great reputation in medicine as well as in astrology, being at this time physician to Henry II of France. Since he was so close to Elizabeth's arch-enemy, it is not improbable that he had an ulterior motive in his predictions. All of his prophecies are worded very cryptically and susceptible of various meanings. An interesting example is seen in the interpretation of a verse from his most popular work, *The Centuries*, published in 1555. There were many English editions in the late 17th and early 18th centuries and in these the commentators sought to demonstrate the accuracy of his predictions. The original [Century VI, Quatrain 74], is as follows:

La dechassée au regne tournera
Ses Enemis trouvez des conjurez
Plus que jamais son temps triomphera
Trois, septante, sa mort, trop asseure.

In the English edition of 1672 this translation is given:

The expelled shall come again to the Kingdom
Her enemies shall be found to be Conspirators,
More than ever his time shall triumph
Three and seventy appointed for death,

and is taken to refer to Charles II. In an edition of 1715 this verse has a slightly different translation:

The Rejected shall for all that come to the Crown;
Her Enemies will be found to have been a band of Traitors forsworn against Her.
The Time of her Reign will be more Happy and Glorious than any of her Predecessors
In the 3rd Year of the Century, at the Age of Seventy
She dies, of which I am but too much assured,

and here the reference is to Elizabeth. This was probably not the meaning given to it in the early years of Elizabeth's reign.

Nostradamus was probably best known to English readers of 1559 from the English editions for that year of the *Almanacke* and *Prognostication* in which occur the predictions so disturbing to the politi-

cal situation in England.[12] The *Almanacke* was printed by H. Sutton for L. Haryson, and the only known copy is in the Huntington Library. It is a typical almanac, and the only predictions are short verses, again so cryptic as to be almost meaningless. Thus on the title page appear:

Foure lynes upon all the yeare.

Feare, yce, greate pillynge, to pass the sea, to encrease the raygne.
Sectes, holy thinges beyond the sea more polished
Pestylence, heat, fyer, the enseygne of the Kyng of Aquilon.
To erect a signe of victory, the cyty Henripolis.

The Prognostication for 1559 was printed in Antwerp, according to the colophon, but it was entered in the Stationers Register to L. Haryson. The only known copy of this is in the British Museum. There are 'predictions and presages for every month' and while they do not refer specifically to England, it will be seen that they could apply very directly to conditions in England at that time, and particularly to the Religious Settlement. One can appreciate the imaginations of a distraught public reading into these gloomy forebodings their own fears. Two of the most striking predictions are for January and September: Thus for January, 1559:

But I find darkely by meane of a certaine new election, partly worthy and partly unworthy, and by this meane more than by any other deedes, many and divers calamities, weepings and mournings; and such mutations shal be as was not sins the time of Halarick and Himerik of the wandales. Never came suche chaunces, yea suche, that many would had never ben borne, seing such sinistre and infortunate adventures: God of his goodnes provide for it whiche is above all . . . They that were not content to belove the thing that was lawfull, shalbe in perpetuall payne, tra-aile, labour, feare, and trouble. To be short, I finde that whiche I dare not write, although it should be very lawefull and necessary: but for a good aspect of benevolence (which comforteth me) God wil provide it. And the greatest part shalbe mitigated and appeased, but not without great civil sedicion and mutination of the lowest against the highest. . . .[13]

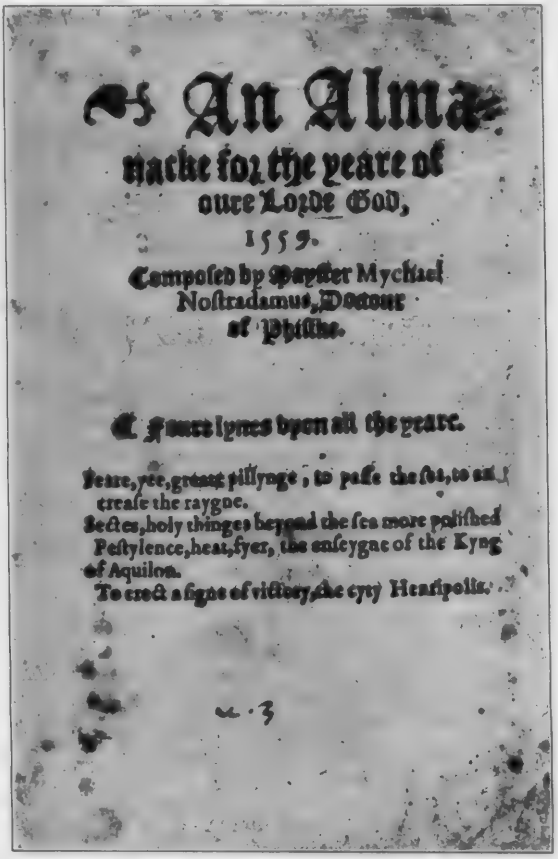
---

[12] There was another work of Nostradamus published in English in this year, *An excellent Treatise shewing such infirmities as shall issue 1559 and 1560*, but this has no political implications. Bosanquet lists (Class F, 31) a prognostication of Nostradamus, 1559, which is not extant.

[13] Sig. A_3-A_8 [for A_5].

September:

But what misery, calamitie and trouble is presaged and pronounced unto us in the rest of the yeare and almoste all the yeare, 1560 and the first three



An Almanacke for the yeare of oure Lorde God,

1559.

Composed by Master Michael Nostradamus, Doctour of Phisike.

Fewe lynes upon all the yeare.

Feare, yee, great pillynge, to passe the sea, to encrease the raygne.
Sectes, holy thinges beyond the sea more polished
Pestylence, heat, fyer, the ensygne of the Kyng of Aquilon.
To erect a signe of victory, the cyty Heraipolis.

TITLE PAGE OF NOSTRADAMUS'
An Almanacke for 1559

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monthes of this present yeare: That whiche is threateneth, concerneth more the courage and minds of the byshoppes and priestes than of any other:

although that their lives, their goods their honour and dignitie dependeth thereupon. That is to wete that there shalbe difference of Sectes, alteration, murmuring against ceremonies, contentions, debate, proces, fuytes, noyse, discorde, discontinuance in the principall solemnpnities, seducing, and sedition of the people, especially to those that shalbe subject unto them, and of them on whome all power shall depende. Howe many prelates shalbe spoyled of their degrees? and by a greate one newe choosen all shalbe set up agayne. Also that some greate monarke by extirpation and pluckyng up by the roote, that men shall saye Nec catulum quidem alendum, shal pacifie all. If I would put in writing al that I finde of this yeare and of the next folowinge, ten sheetes of paper would not suffice. Let us pray God that it wold please him to pacifie all, and sustaine him that shall pacifie it.[14]

The rapidly culminating events of the years 1558 and 1559 tended to justify the dire note of the prophecies. The marriage of Mary Queen of Scots and the Dauphin of France, the death of Mary of England and the accession of Elizabeth, with the resulting religious dispute, the marriage of Philip with Elizabeth, not of England but of France, the dramatic death of Henry II from the accident of the jousting match which brought Francis to the throne and the Guise family into power, and the possibility of war with France over Scotland, these all served to build up a feeling of impending calamity for England, as had been foretold by the stars.

Among the contemporary references to the prophecies of Nostradamus, one of the most interesting is Matthew Parker's, at the time that he was being proposed for the Archbishopric of Canterbury. Parker was hesitant about accepting this office, and Strype[15] offers this explanation:

Parker's judgment of prophecies.

[Nicholas] Bacon, it seems, had given him some hint, as though one reason of his declining to accept this preferment, was his fear of sad times, conceived from some prophecies, that then went about, of Nostredame and others. Whereat he wrote thus in answer: "I pray you think not, that the prognostication of Mr. Michael Nostredame reigneth in my head. I esteem that fantastical hodge-podge not so well as I credit Lucian's book *De veris*

[14] Sig. [D_8^r]-[D_8^v].

[15] John Strype, *The Life and Acts of Matthew Parker* (Oxford, 1821), Vol. 1, Bk. 1, Chap. VIII, p. 76. This letter is also printed in *Correspondence of Matthew Parker*, edited for the Parker Society by J. Bruce and T. T. Perowne (Cambridge, 1853), pp. 57-63. The letter, Lambeth M. S. 959, No. 37, is dated 1st March, 1558-9.

Narrationibus: nor yet all other prophecies of Sands, more than I regard Sir Tho. Moor's book of *Fortune's Answers upon the Chance of Three Dice casting.*

The general reaction of the public to these prognostications, and particularly to those of Nostradamus, has been told by Fulke and by Francis Coxe. Coxe, a quack doctor and recanting sorcerer, in his *A short treatise declaring the wickednesse of magicall sciences*, 1561, says of the activities of astrologers:

> Nay they seassed not here, but so blinded and bewytched the wittes of men, that scant durst thei credit God him self, if it semed that their blinded prophesies any time woulde make contradiction. How wel this appeared in the yeare of oure Lorde God, 1559, at what time our most noble soverain began her Imperial Governement and raign over us, all men maye judge, and easelye perceive. For although it was well knowen unto all men, what love and godly zeale, her most royal majestie had and did bear to the trew prophetes of God, his afflicted flock and woorde of the crosse, yet did the people so waver, the whole realm was so troubled and so moved with the blinde enigmatical and develish prophesies of that heaven gaser Nostradamus, in such sort, that even those whiche in their heartes coulde have wished the glory of God and his worde moste florishing to be established: were broughte into suche an extreme coldenes of faythe, that they doubted God hadde forgotten hys promise.[16]

Coxe criticizes briefly the grounds of astrology, and says: "I neede not here speake any more of it, for who list to reade the commendable worke of fulce [Fulke], uttered too thesame intent, shall finde of what force it is." [17]

And it is in this work of Fulke that we find the most specific examples of the effect of the predictions, especially as they related to the efforts of Parliament to achieve the Religious Settlement and to solve the vexing question of Supremacy. Fulke cites the credence given to Nostradamus as one of the pernicious influences of astrology.

> What? is it to be kept in syience, howe slowlye and coldly the people in the last yeare, seduced by the foolyshe prophesye of Nostrodamus addressed them selfe to sette uppe the true worshippynge of GOD and hys religion, good Lord what tremblynge was there? What feare? What expectation? What horror? Leste all thynges sodenlye shoulde bee turned up sydowne,

[16] Sig. A_4^r-$[A_5^r]$.

[17] Sig. $[A_6^v]$.

so that none almost of them that gave any credite to prognostications, durst be bolde to open their faythe and religion, whyche they bore in theyr hartes. Yea thys Nostrodamus reigned here so lyke a tyrant wyth hys south saiynges that wythout the good lucke of hys prophesies it was thought that nothyng could be broughte to effecte. What shal I speake of the common peoples voyce? Thys daye the Bishoppe of Rome must be driven out of the Parliament. To morow the Queene shal take upon her the name of supreame head. After .xx. dayes all thing shall waxe worse. Such a day shall be the day of the last judgement, that except the true prechers of Goddes holye woorde hadde sharpelye rebuked the people for creditynge suche vayne prophesies, there shoulde have bene none ende of feare and expectation. But oure craftye Nostrodamus, that coulde wrappe hys prophesyes in such darke wryncles of obscuritye, that no man could pyke out of them, either sence or understandyng certain. Without doubte he hath herde of the oracles of Appollo, whiche the devyll at Delphos, gave out of an ydoll to them that asked counsel, whiche were obscure, double and suche as myght chance bothe waies.[18]

It is not only Nostradamus that he attacks for this kind of prophecy, for the English astrologers are also guilty:

for not only Nostrodamus telleth thyngs darkly and doubtfully, but divers others: yea many of our countreymen, as Cunyngham, a man otherwise bothe lerned and honest, Hyll, Lou, Vaghan, and not longe ago Askham, with sixe hundred more of that sort, among whiche, the afore named, maye chalenge the chiefe place, not that they prophecie truer then other, but that they have more exactly (as they say them selves) formed their calculation to the course of the starres.[19]

While Fulke's aim was to discredit those astrologers whose predictions were proving a disturbing factor in the setting up of the new religion, his work, as a whole, is a remarkably sound criticism of astrology as a science. He differentiates sharply between 'the moste beautyfull and certayne science of Astronomye' and 'the dotyng of Astrologie.'

this is common to all sciences, that they may bee demonstrated. For although the principles and grounds in every arte, be of suche nature, that they canne not bee shewed and confyrmed by things more general, and therfore it is said, that they can not be proved, yet by demonstration or induction they maye be so playnly sette before our eies, that no man neede to doubte, but that they are moste true and certain.[20]

But by no waie is it possible, that the principles of this arte of Astrologie, may be either demonstrated or proved. Ther is no mean wherby mans witte

[18] Sig. [A_7^v]-[A_8^v]. [19] Sig. B_1^r. [20] Sig. B_2^r-B_3^v.

may atteyne to so greate knowledge, ther is no methode, no induction, that can maintayn truth of these propositions, whyche they take for their principles.[21]

Particularly does he deplore the predictions of war:

And to begyn with that whyche semeth chieffest among theym, to prognosticate of warre and peace, I mervayle that menne are so madde, as to looke for warre oute of theyr predictions, knowing that the cause therof proceedeth not of the starres, but of the devyll, whyche alwaye labourethe to breake the bonde of unitie and concorde, that shoulde be among christian men.[22]

He denies the validity of astrology even in medicine, and in this he was more advanced than most of the other opponents of judicial astrology, including Calvin, who said: ". . . we must needes confesse that there is a certain convenience betwyxte the starres or planets and the dispocion of man's body." [23] But Fulke is very emphatic in denying any virtue to the stars in such matters:

Sycknesse and healthe depende upon dyvers causes, but nothyng at al upon the course of the starres, for what way soever the starres runne their race, yf there be in the body abundance or defect, or from outward by corruption of the ayre infection it must nedes be sycke: and if none of these bee, though all the starres in heaven with all their oppositions and evil tokens shuld meete in the howse of sicknesse, yet the body shoulde bee whole, and in good healthe.[24]

He ridicules the usual advice of the prognostications on the proper times to sow and plant, to buy and sell, to travel, and to marry, with amusing parody, as in this example:

Good dayes to bye and selle, bee market dayes, and all other whensoever a manne canne gette a good bargayne with honestie. I thynke but fewe marchantes wyll leese their mart in waightyng for heavenly healpe frome the starres.[25]

At the conclusion of the first treatise he sums up the case against astrology and challenges its defenders:

[21] Sig. B_8^v.
[22] Sig. [D_6^r].
[23] Jean Calvin, *An admonicion against astrology iudiciall, and other curiosities.* Tr. G. G[ylby], London, R. Hall (1561).
[24] Sig. [D_7^r].
[25] Sig. E_8^v.

And that we may make haste to the haven that is not nowe farre of, seynge this apishe arte is unprofitable to the woorkes of phisike, to the profite of the studentes, to the state of the common wealth: and seyng that without principles nothyng can be knowen: but astrology consisteth either of no principles, or of false, it is loste labour that is spent in thobservation therof: in vayne it is to credite their predictions, unjust it is, that she is of the unlerned people reverenced, more worthy to bee buried under the chanell of *Lethe,* the ryver of oblivion, than that she shoulde enjoying the cleare lyght of men, be had in any estimation. But if there be any Prognosticatour that will take uppon hym to defende Astrologie thus battered in pieces, let hym make haste to dooe it, before she utterlye falle to ruyne.[26]

Fulke shows the same rational attitude in his *Goodly gallerye.* He denies the influence of comets on civil or political affairs, assailing the astrologians, and ridicules many of the current superstitious beliefs, as the magical virtue of stones, and the ambitious dreams of the alchemists.

During the next few years the activities of the prophesiers continued and in the Parliament of 1562-3 it was thought necessary to make more stringent the laws against them. An Act was passed very similar to that of Edward VI, stating that since the expiration of the previous law " divers evill disposed persons, enclyned to the stirring and moving of Factions Seditions and Rebellions within this Realme, have byn the more bolde tattempte the lyke Practice, in fayning imagining inventing and publishing of suche fonde and fantasticall Prophecies." The Act provided severe penalties for anyone who, in any way, put forth such prophecies, based on heraldic devices, " or by reason of any Time Yere or Daye name Blodshed or Warre, to thintent therby to make anye Rebellion Insurrection Dissention losse of Lief or other Disturbance within this Realme." [27] At the same Parliament there was also an Act against conjuring, enchantments, and witchcraft.

In 1562 twenty book-sellers were fined for selling a prognostication of Nostradamus, printed by William Powell. Although this action has usually been considered a case of pirating, it is more likely that the work had been published contrary to the Queen's Injunctions or to the Act of Parliament. Unfortunately no copy of

[26] Sig. [C$_8$^{v}].
[27] *Statutes of the Realm* (1819), 5 Eliz., Ch. 15.

this book seems to have survived, so we cannot tell what the prediction was.

At about this same time the two Pole brothers were again discovered in a plot to bring about the accession of Mary Queen of Scots. They had been told by a conjurer that Elizabeth would die the following March and had made plans for an invasion of England by France. Many times later during the reign of Elizabeth there were to be similar rumours of her impending death.

Such a persistent belief as that of the influence of the stars on human affairs cannot be overcome simply by legislation, and works, like that of Fulke's, designed for the common people, were more effective, particularly since they were related to the prevailing religious opinion. The Puritans held astrology to be one element of what they termed 'superstition.' Calvin's treatise against judicial astrology appeared in 1561, and there are many passages in the sermons of the Puritan divines that show this same point of view. These events of the first years of Elizabeth's reign illustrate the intimate relation between religious, political, and scientific thought. It is quite possible that Fulke might never have written this really valuable scientific work had he not been goaded to it by the political and religious conditions of the time.

While these predictions and the subsequent attacks on the validity of astrology relate to only a brief period of history, it was a very crucial period and one in which many significant changes were taking place, especially in thought. The various reactions to the prognostications are typical of the time, and give a good cross-section of the general mental attitude. It is essential that we appreciate the importance of this element in human thought, for even today many still believe in astrology, and it continues to have its implications in political affairs.

A BRIEF HISTORY OF PUERPERAL INFECTION

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The history of puerperal fever goes back to the oldest medical documents extant. No problem connected with midwifery has claimed more attention on the part of investigators and the condition has always been preeminent in the list of causes of maternal death since vital statistics have been accumulated and published. Epidemics of puerperal sepsis, highly fatal in character, swept Europe and Great Britain from the middle of the seventeenth century on and drew the attention of the laity as well as the medical profession to this major hazard of childbearing. However, the etiology of the condition has been determined only within the last hundred years and even at the present time there are disconcerting gaps in our knowledge. That the problem is far from being settled is evidenced by the fact that puerperal sepsis is still the most frequent cause of maternal death throughout the world. The following is a brief résumé of the literature on puerperal infection, compiled in an effort to determine by what steps our present knowledge of the condition has been attained.

The earliest known reference to puerperal infection is found in the writings attributed to Hippocrates who lived during the fifth century B. C., and who has been aptly termed the " Father of Midwifery " as well as of medicine. He taught that fever appearing during the first days of the puerperium was due to suppression of the lochia; that this suppression occurred as a result of an accumulation or lack of balance of the " humors "; and that free evacuation of the patient's bowels subsequent to delivery was of the utmost importance in order to rid the body of the noxious element. In the Hippocratic tract on diseases of women, *De Mulierum Morbis*, there is a description of the course of a severe case of puerperal fever that might well suffice for a textbook of today.

If, however, the purgation of the puerperium does not take place, the next thing is likely to be a fever with a chill, while the abdomen becomes swollen. If you touch the patient the whole body feels the pain of it, and especially if

anyone should touch the abdomen. At the same time also a burning sensation in the abdomen is noted and there are apt to be pains in the loins. The patient's appetite becomes fastidious, and wakefulness and irritability occur. After this, on the fifth or seventh day, there may be an evacuation of the bowels, and the material passed is black and is sometimes of a very bad odor. The urine is not unlike that of an ass. If this movement of the bowels takes place it appears better for the patient and with proper treatment she may be restored to health. The arterial pulse is always weak, at times also quick, more rarely strong, but thin. This occurs at the beginning of the disease and is apt to continue. Fomentations should be applied to the external genitals made of sweet smelling herbs, which, if applied every day, will bring about an improvement of the conditions. If, however, the matter that should be purged after the puerperium be carried forcibly to the head or to the thorax and lungs, which sometimes happens, death may rapidly take place if it is detained there.

It is not necessary to emphasize the influence of the Hippocratic teachings upon subsequent medical thought, but it is noteworthy that 1500 years were to elapse before anyone was to seriously question them.

In the first century A. D., Celsus wrote in detail of various obstetric conditions and although differing with Hippocrates on certain problems upheld his views as far as the etiology of puerperal infection was concerned.

The first medical treatise dealing exclusively with diseases of women appeared in the second century A. D. by the hand of Soranus of Ephesus, and that portion dealing with puerperal fever was merely a reflection of Hippocratic beliefs. Moreover, Galen (about 200 A. D.), Aetius (about 500 A. D.), Avicenna (about 1000 A. D.), and Albucasis (1085 A. D.), included paragraphs on the subject in their voluminous writings and all supported the teaching of Hippocrates.

The works of Soranus were well preserved and became the original for the famous *Rosengarten* of Röslin which appeared in 1513. In 1545 the latter was translated by Thomas Raynalde and under the title of *The Byrth of Mankynde, or the Woman's Book*, was the first book of midwifery to appear in the English language. The following citation deals with puerperal infection.

It is also to be understanded, that many times after the deliveraunce, happeneth to women either the fever, or ague, or swelling, or inflations of the

bodye, other tumblynge in the belly, or elles commotion or settelinge out of order of the Mother or Matrix. Cause of the which things, is sometimes lack of due and sufficient purgation and cleansynge of the flowers after the byrth, or elles contrarywyse, over muche flowinge of the same, which sore doth weaken the woman. Also the great laboures, and styrrynge of the Matrix at the byrth. Now seinge thus that it by so manyfolde occassions and causes, it shal be mete that women in this case be nothing ashamed to desclose their minde unto expert physitians, showing them every thynge in it, as they knowe whereupon it shoulde come, so that the physitian understanding the womans mynde, maye the soner by hys learnynge and experience consyder the true cause of it, and the verye remedye to amende it.

This work also contained detailed instructions for the treatment of puerperal fever, once the condition had developed; the following paragraph probably gives the typical therapy in use at this time.

Then as oft as it commeth for lacke of due purgation of the flowers, there must be ministered such things the which may provoke the same, whether it be by medicine taken at the mouth, or by lotion and washing of the feete, or by fumes, or odores, emplaistration, or by decoction of herbes serving to that purpose, or elles by oyntments, and such other things, according as the person or the perill doth require: of the which things few or no women be ignorant. And ye yet must take diligent heede that she be exactly and utterly purged. To this be agreeable all such simples the which provoke urine, and open the veynes, making free way for the blood to passe, and send the humours and matter downward. Howbeit as neere as ye can, use none of these things without the counsell of an expert Physitian, lest whilst ye helpe one place ye hurt another: also to sneeze, helpeth much to this matter, and to hold in the breath, enclosing the nose and mouth. Also a fumigation made of the eyes of salt Fishes, or of the hoofe of a Horse, put underneath, provoketh the flowers. If ye profit not by this means, then being able to beare it, let her blood in the veyne called Saphena, under the ancles of the feet, for this provoketh flowers chiefly of all other things.

It seems obvious that this work contributed nothing toward furthering an accurate knowledge of the etiology of puerperal fever. It is probable that the first real advance since the time of Hippocrates came from Mercatus who stated in 1570 that the development of fever in the puerperium was caused by the putrefaction of lochia retained in the uterus. This is the first implication of putrefactive processes in the condition. Some years later, Mercatus altered his views to the effect that all acute maladies of the puerperal woman were caused by inflammation of the womb, which in turn was due to

a difficult labor. Here, at last, was a definite step toward a true understanding of puerperal infection. In 1575, however, Ambroise Paré, one of the greatest obstetricians of the Renaissance, attributed the fever of the puerperium to a " cold of the uterus," to the introduction of cold air into its cavity, or to the suffusion of the natural discharges. These, in turn, produced a " suffocation of choking of the womb, griping pains in the bowels, and the fevers and other accidents which were often followed by death."

Throughout the seventeenth and eighteenth centuries it was commonly believed that anxiety or violent disturbances of the spirit were frequent causes of puerperal fever and the first to promulgate this doctrine was Rodericus à Castro, who in 1602 stressed " sad affections of the soul " as contributing to the etiology of the condition. In about the same year, however, Felix Plater wrote in a much more enlightened vein.

> First of all, because of the difficulty of labor, the great pain and effort involved, the uterus frequently becomes inflamed. Then, either because the foetus or some of the secundines remain, or even after these have been expelled, pain and fever may assert themselves because of the inflammation that had begun before their expulsion. The retention of the secundines alone would not affect them so rapidly as this inflammation, which is likely to follow, and which constitutes the chief cause of death except in those cases in which there is a large loss of blood.

In 1612, there appeared the second textbook of midwifery to be published in English, entitled, *Childbirth or the Happy Deliverie of Women*, but it contains no reference whatever to puerperal fever.

Sennert (1634) wrote at some length on the complications of the puerperium and asserted that fever in this period arose " either from a suffusion of the lochial discharge or from an accumulation of noxious humors during the time of gestation, which are put in motion by the succeeding labor." A few years later, (1640), this author stated a depraved condition of the blood was often the primary cause of the affection.

At about this time Riverius, who agreed with Sennert as to the etiology of puerperal infection, advised that the best therapy consisted of " emollient opening clysters, and cupping glasses to be fixed to the groin and hips." If, however, no improvement was effected

by these means, he suggested as a further procedure that "the veins about the knees and in both thighs are to be opened, or the haemorrhoidal veins, if nature seems to point that way. But if the fever be attended with a total suppression of the lochia, then a vein must be opened in the arm."

William Harvey (1651) made the rather acute observation that

> foul and putrid lochia sets up fever and other violent symptoms. Because the uterus, torn and injured by the separation of the placenta, especially if any violence has been used, resembles a vast internal ulcer, and is purified and cleansed by the free discharge of the lochia. Therefore, do we conclude as to the favorable or unfavorable state of the puerperal woman from the character of these excretions. For if any part of the placenta adhere to the uterus, the lochial discharges become fetid, green, and putrid; and sometimes the powers of the uterus are so reduced that gangrene is the result, and the woman is destroyed.

This concept of conditions within the uterus after parturition was of the utmost importance and ranks as one of the major contributions to the etiology of puerperal infection.

The first epidemic of puerperal infection on record occurred in Leipsig in 1652, and was followed by another in 1665. According to Burtenshaw, 216 different epidemics occurred between 1652 and 1862. This first epidemic was extremely fatal; it is stated that only one in ten patients escaped death. The early epidemics seem all to have occurred in Germany and although Paris is said to have suffered in 1664, this seems dubious. It was probably not until 1746 that the Hôtel-Dieu had twenty cases of puerperal sepsis in rapid succession without a single recovery.

In 1653, the third English publication on midwifery was presented under the title of *The Childbearer's Cabinet*. Later in the same century, we have two more, viz., a manuscript for the instruction of midwives by Dr. Percival Willoughby of Derby (1670) and *The Compleat Midwives Practice Enlarged* (1698). Prior to the eighteenth century, no epidemic of puerperal infection was reported in the British Isles, although several had occurred on the continent. It seems significant that no mention whatsoever is made of puerperal sepsis in the above three books.

Thus far, the seventeenth century had contributed very little to the causation of puerperal fever and general medical opinion re-

mained at the stage reached by Hippocrates. An example is afforded in the simple statement of Sylvius, that the condition was due to " suffusion of the lochia," with the suggestion of treatment by " aromatics impregnated with a volatile salt, and uterine medicines, such as promote sweat."

The great French obstetrician, Mauriceau, while also ascribing puerperal fever to suppression of the lochia, seems to have been the first to draw attention to the peritonitis which often follows severe sepsis and which constitutes the commonest cause of death in this condition. In 1668 he wrote as follows:

> This sudden suppression of the lochia, the matter of which choking up, as it were, the whole substance of the uterus, and there stagnating, causes a great distention of the part, and an inflammation, which communicates itself, by means of the peritoneum, to the whole hypogastric region; which hence becomes inflated, distended, and extremely hard, and if the complaint is not soon removed, it frequently proves fatal in a very short time.

At the same time, (1668), Raymond Fort, after a hundred years again drew attention to the putrid character of many cases of infection, as first suggested by Mercatus in 1570, and his views were further emphasized by Hervé in 1690. Thomas Willis, best known for his investigations in the field of neurology, was the first to suggest anything resembling a modern terminology of the condition. In a work on fevers entitled *Febris putrida,* (London, 1675), he wrote at some length on " febris puerperarium." His treatment was: " a vein should be opened in the foot, or leeches applied to the haemorrhoidal veins, but if necessity urge, the operation may be performed in the arm." Willis apparently enjoyed very little success with the above therapy and it is an amusing commentary that Charles the Second is reported to have said that " Willis has robbed me of more subjects than the army of an enemy would have done."

Sydenham in 1682 wrote a dissertation on puerperal fever and expressed the belief that women rising too early after childbirth would be seized by " the hysteria disorder, which, in this case brings on a total suppression of the lochia," etc.

One of the common terms still used by the laity to describe puerperal infection is " milk fever "; since the symptomatic onset of the former frequently coincides with the establishment of lactation it

was natural for writers of this time to connect the two conditions. The earliest reference to the theory of milk metastasis is found in the works of Sennert, (1634), to which reference has already been made. Sennert, however, was very vague in his ideas and the first clear account of the theory was advanced by Puzos in 1686. He stated that " milk, circulating in the blood, is attracted to the uterus during pregnancy and to the breasts after confinement, but metastases might form in other parts and produce the symptoms of malignant or intermittent fever."

As a final contribution to the seventeenth century literature Peu of Paris (1694) first accurately described a case of inflammation of the abdomen or peritonitis due to retention of the placenta.

Thus, the seventeenth century closed with considerable writing but very little progress made toward a true knowledge of the etiology or treatment of puerperal infection. Nevertheless, due probably to epidemics prevalent on the continent and soon to manifest themselves in Great Britain, physicians were beginning to focus attention more and more upon our subject, whence the eighteenth century was to be much more fruitful in the accumulation of sound ideas.

Boerhaave, apparently as the first writer of note, supported in 1709 the then prevalent etiology of milk metastases. By way of treating this condition he recommended, " gentle anti-acid remedies to sheathe the acid serum; soft diluents; the mildest specific aperients, from the moderately cordial, uterine class; topical deobstruents, clysters, fomentations, cataplasms, linaments, cupping glasses, pessaries, and suppositories. Bleeding should never be practiced in this disease without the utmost urgent necessity."

In 1716, there appeared in London a book entitled " Criticon Febrium or a Critical Essay on Fevers " by Edward Strother. This short work summarized the opinion of the times on fevers in general and included a short chapter on the fever of the puerperium. Strother apparently had some hazy notion of a considerable similarity in cause and effect between this specific variety of fever and those of other types, and stressed inflammation as the general cause. " Puerperal fevers are shelves poor females are often staved upon. They are generally inflammatory, from the inflammation of the uterus, which arises from the suppression of the lochia. 'Tis com-

mon for hard labours to produce them." For some authorities, Strother deserves the distinction of being the first to point the way to modern concepts of puerperal fever. Also, he was the first to use the term " puerperal fever."

In 1719, Pierre Dionis, known best for his treatises on anatomy and surgery, gave the following simple directions for the treatment of puerperal infection.

> Let the Patient have a cooling and spare Diet, drinking only weak Broth made of Veal or Pullets, with Lettice, Purkstance, Succory, Borrage, Sorrel, or the like. . . . Let her Body be kept open with simple Anodyne Clysters, and let her lie still. Bleeding is a most powerful Remedy in this Case; and therefore we must begin with it, and repeat it in a short time. . . . Above all, let us shun Purgatives, most mild soeven; for as they are prejudicial in all Inflammations and Fluxions of the Womb, they are particularly so here.

As evidence of the current tendency to ascribe many disorders, including fevers, to the emotions, one finds the Sieur de la Motte of Paris (1722) writing that puerperal fever was due to a suffusion of the lochia, and the suffusion to " a furious transport, extreme fear, extreme joy, by the odor of a flower, by catching cold," etc.

Mead, in 1742, described very well the conditions found at autopsy in patients dying of puerperal sepsis, finding the intestines inflamed and an effusion present in the abdominal cavity. However, he found the uterus in many cases to be macroscopically healthy in appearance (probably acute streptococcic infections) and so concluded that inflammation of the omentum and intestines was the primary factor.

The theory of milk metastasis reached its height at about this time when, in 1746 A. de Jussieu, Col de Villars, and Fontaine stated that in autopsies on women dying in the puerperium they found " a free lactescent fluid in the lower portion of the abdominal cavity and clotted milk adherent to the intestines."

The first epidemic of puerperal fever to be investigated from a scientific standpoint occurred at Lyons in 1750. Claude Ponteau did autopsies on several women dying in the epidemic and published his findings. He, however, contributed nothing directly toward the solution of the etiology of the condition, although his diagnosis of " epidemic erysipelas of the peritoneum " is significant and descriptive.

It will be noted that, up to this time, no one had suggested the possibility of transference of puerperal fever to the patient by an outside agency. John Burton (1751) deserves credit as the first author to make a suggestion in this direction, when he stated that inflammation of the uterus during the puerperium was caused either by suffusion of the lochia or by carelessness of the midwife or others attendant at delivery. Smellie (1762) and Cooper (1766) agreed with Burton that carelessness on the part of attendants might frequently result in puerperal fever but failed to state how this was brought about. Mesnard (1753) deserves mention for a most accurate description of the inflammatory processes in the uterus set up by puerperal infection.

Not a great deal had been written hitherto on operative gynecology, but in 1765, Jean Astruc published a six volume work on diseases of women, which included procedures in use at the time. In the section on puerperal diseases, he merely harks back to the old theory of obstructed lochia. Cooper (1766) deserves mention as the first to caution against the prevalent practice of bleeding as a major therapeutic measure. He was followed by Denman (1768), Johnson (1769), Millar (1770), and Manning (1771), with the result that at the beginning of the nineteenth century this form of treatment was rarely employed in England, at least. It seems probable, however, that the feeling of the above authors was based upon a false conception, since all agreed that puerperal fever was inflammation of the uterus usually caused by "violent disturbance of the spirit," and hence, presumably, not amenable to treatment by blood letting.

It will be noted that, by this time, the essentially inflammatory character of the fever was generally recognized in England. On the continent, Tissot of Lausanne voiced the same opinion in 1770, and fourteen years later came to view putridity of the uterine contents as the essential cause.

Manning (1771) had already drawn attention to the putrid character of many cases of puerperal fever, an idea not new to him; and Hulme (1772) stated that "the pains being long pent up, by the pressure of the gravid uterus, become putrid. This soil . . . affords an ample source of putrefaction to irritate and corrupt the intestines, and, at length to infest the whole fabrick." In view of this fact,

Hulme recommended treatment by clysters, laxatives, ipecac and opiates. He wrote: "The clothes of puerperal women should be frequently changed for clean, dry, warm ones; lest by retaining a great quantity of putrescent steams, they should add fuel to the disorder. All kinds of bandage, upon the trunk of the body, must likewise be avoided; lest by their pressure upon the tender abdomen and inflamed viscera, they should help to increase the trouble."

We have seen that certain authors, notably John Burton, had suggested that puerperal fever often resulted from carelessness of attendants at the time of delivery. No one, however, had believed the condition to be of a contagious or infectious nature. The credit of being the first to in any way use either of the above terms belongs to John Leake, of London, who in 1772 published an article entitled *Observations on Childbed Fever*. Here we find the following significant sentence: "The childbed fever, when produced by a distemperation of the air, like the epidemical dysentery or ulcerous sore throat, may at last become infectious; but when it only arises from such accidental causes as have already been enumerated, and which are confined to particular habits and constitutions, I believe it will then never communicate itself to a second person." This statement is, of course, far wide of the actual mark, but while amplified, as will be shown later, by Joseph and John Clarke, by Alexander Hamilton, and finally made a definite hypothesis by Alexander Gordon (1795), Leake made the first suggestion of our modern conception of the etiology of puerperal infection.

In the opinion of many historians, Charles White of Manchester was the first writer after Hippocrates to make any substantial contribution toward the solution of the etiology and proper treatment of puerperal infection. White believed puerperal fever to be an absorption fever and, in 1773, wrote as follows:

> The lochia stagnating in the wound, and in the folds of the vagina, soon grows putrid, for it is well known that the mildest humors in the human body, if suffered to stagnate, become so, as soon as the air has access to them. These are in part absorbed by the lymphatics in the womb and vagina, . . . The danger does not arise from the smallness of the quantity of the discharge, but from its stagnation, whereby it becomes putrid and in this state is again absorbed into the circulation.

Furthermore, White antedates Sir James Y. Simpson in stressing the similarity between puerperal fever and surgical fever. Finally, we see in his therapeusis distinctly modern ideas. He placed his patients in a semi-recumbent posture to facilitate drainage, using a bed designed by Dr. Vaughan. This bed was an ingenious mechanical contrivance, not unlike the modern hospital bed; the position was essentially the "Fowler's position" in use at present. White also used mild antiseptic douches and insisted on rigorous cleanliness (asepsis) and thorough ventilation of the lying-in room, with complete isolation of infected patients.

The next year, 1774, Thomas Kirkland wrote on the subject and in his dedication (to White) states, "I must confess, Sir, I cannot approve of the modern doctrine, which asserts that the puerperal fever is a disease *sui generis*." After noting that if coagulated blood be retained in the uterus, it will communicate an inflammation to the uterus when it begins to putrify, he asks, "Does not this analogy hold good, when the puerperal fever is owing to putrid effluvia being taken into the habit by the absorbents *ab extris*? . . . and are not the putrid effluvia, arising from the locheal discharge, in lying-in hospitals, capable of producing the same disease?" Finally, Kirkland deserves attention for insisting upon the recognition of fever as a symptom and not at a disease. This last statement was amplified the following year by William Butter of Derbyshire who wrote "All inflammatory symptoms must be considered as a complication and by no means as essentially constituting any part either of the cause or nature of the puerperal remittent fever."

Despite these advances, we find the eminent William Hunter in 1774 ascribing the fever to inflammation of the omentum; and Johnston (1779) agreed with him. About this time, a fatal epidemic of puerperal infection was raging in England, as is indicated by the following excerpts from William Hunter:—"We tried various methods (of therapy). One woman we took from the beginning and bled her, and she died. In another, we gave cooling medicines, and she died. In a third, we gave confect. aromat. and other cordials and stimuli, and she also died."

The year 1781 is memorable for the first positive statement as to the infectious nature of puerperal infection. This was contributed

by Alexander Hamilton who stated " The Childbed fever is remarkably contagious, and when epidemic, capable of being propagated from one person in the puerperal state to another." Another contribution came at about this time from Philip Pitt Walsh, who wrote " I will venture . . . to assert, that the disease is not one *sui generis*, confined to Inlying Women, but merely an unusual form of a very common disease, no other than the common infectious fever, complicated with a more or less extensive inflammation of the peritoneum." (London, 1781).

These new ideas were slowly accepted on the continent. Thus, Delaroche (1783) supported the old theory of " violent upsets of the spirit " as the main etiologic agent. Nolte (1785) affirmed that puerperal fever was of the nature of so-called bilious fever, but that it was frequently complicated by putridity. To counteract these backward trends, Cruickshank (1787) gave the final refutation to the old milk metastasis theory when he proved that " the phenomena which one observes in the lower belly are properly the result of inflammation of the peritoneum; they are found equally in man, whose breasts do not contain secretion, and in non puerperal women." Cruickshank's statements were confirmed a few years later by Bichat (1800).

It should be noted that Baudelocque, while contributing nothing definite to the knowledge of puerperal infection, suggested (1789) that the introduction of the hand into the parturient canal and the use of instruments must be considered as factors in the etiology of puerperal infection. This marks the first definite contribution to the prophylaxis of the disease which we have found in the literature.

Much credit is due to Dr. Joseph Clarke for his intelligent handling of patients during the epidemics of puerperal sepsis in Dublin (1767-88). Writing in 1790, he recommends isolation of all infected patients, thorough washing of bed linens and mattresses, and repainting the walls and floors of the wards, as well as the beds. The windows of the wards were then kept open for two weeks before new patients were admitted. He furthermore stated his belief that the nature of the condition " rendered it probable that this fever derived its origin from local contagion, and not from anything noxious in the atmosphere. So the wards where the infection had occurred were closed and the epidemic ceased."

John Clarke, in 1793, summed up current opinion when he wrote (*Practical Essays on the Management of Pregnancy*):

> Other writers think that the puerperal fever has evident marks of purtrescency, the cause of which has been traced to misconduct in the early part of pregnancy, such as tight stays or petticoat bindings, which, together with the weight of the uterus, detain the faeces in the intestines, the thin putrid parts of which are taken up into the blood. This is followed by loss of appetite, in consequence of which bile is collected and becomes putrid, and is absorbed.

Clarke's own opinions were rather more enlightened.

> Accidental violence offered to the parts concerned in parturition will also sometimes lay the foundation of a fever, such as stimulating the os uteri, either by too frequent examinations or by attempts to dilate it. Violence offered by the improper use of instruments may also become a cause of fever. The hasty delivery (manual) of the placenta immediately after the birth of the child can never be necessary, except in cases of hemorrhage, and must endanger the life of the woman in many cases.

We now come to the most conclusive writer of the eighteenth century to be quoted. To Alexander Gordon, of Aberdeen, is due the credit of preceding Holmes and Semmelweis by half a century in the matter of a clear-cut statement as to the contagious and infectious nature of puerperal infection. In this *Treatise on the Epidemic Puerperal Fever* (1795), he makes the following assertions:

> That the cause of this disease was a specific contagion or infection, I have unquestionable proof. This disease seized such women only, as were visited, or delivered, by a practitioner, or taken care of by a nurse, who had previously attended patients affected with the disease. Every person, who had been with a patient in the Puerperal Fever, became charged with an atmosphere of infection, which was communicated to every pregnant woman, who happened to come within its sphere. It is a disagreeable declaration for me to mention, that I myself was the means of carrying the infection to a great number of women.

To prevent all this he recommended the burning of the bed clothes and apparel of the infected patient; thorough washing of the person of the attendant doctors and nurses together with fumigation of their apparel.

One of the most interesting and influential characters of British

obstetrics at this time was Thomas Denman (1733-1815). Apart from authorship of numerous manuscripts he published a book on midwifery which was the accepted text of the time. In his early life, 1768, he supported the prevalent theory that puerperal infection often proceeded from " violent disturbances of the spirit." But, in his textbook of 1801, his opinion had changed and he supported Alexander Gordon in the following manner.

> This is the contagious nature of these fevers; it having long been suspected, and being now *fully proved*, that they may be, and often have been conveyed by midwives and nurses, from one patient to another. This fact explains the reason why persons, practicing for many years with the most enviable success . . . without any change in the manner of this practice, met with a number of unfortunate cases.

In 1814, John Armstrong carried this reasoning at the point of insisting that no one having anything to do with an infected puerperal woman should go near a normal lying-in woman. The next year (1815) David Hosack of New York, the first American physician to write on the subject, stated that: " Puerperal fever is not infrequently highly contagious." Furthermore, he added that, in some of the cases, the disease was probably conveyed by the accoucheurs themselves. In the same year William Hey, Jr., wrote somewhat naïvely as follows:

> No one supposed the sporadic Puerperal Fever to be contagious; and in proportion as the disease becomes epidemical, it is more difficult to judge of its nature in this respect; for as epidemic diseases are in some measure connected with the state of the atmosphere, all are alike exposed to the predisposing cause at least. It is an invariable rule with me never to attend a patient in childbed, in any article of clothing which had been in the presence of one affected with Puerperal Fever; nor without repeatedly washing such parts of my person as could have been exposed to infection. This trouble I took for the satisfaction of my own mind, and the safety of my patients, though not convinced that it was necessary (1815).

Albeit without obstetric intention, Labarraque (1819) made the first chlorine solution for disinfecting purposes. During the same year, William Street suggested sterilization of supplies and equipment by dry heat. Six years later the Bulletin of the Commission of Health of Marseilles, (1825), contained the following significant statement: — " The physician, almoners, servants, and all those

who take care of the sick, before approaching them, and on quitting them, (are) to wash their hands with chlorureted water." In 1827, Alcock contributed the first article on the medical use of chlorurets. These items mark the beginning of surgical disinfection and sterilization which form such an integral part of modern obstetric technique.

About the same time, George Hume Weatherhead (1819), after careful anatomic study, described the pathology of puerperal fever as identical with erysipelas. Lowder, John Abercrombie, Charles Waller, and Robert Lee amplified his studies and conclusions. The latter, (1831), under the title of "Uterine inflammation in puerperal women," published the results of careful autopsy studies and distinguished definitely general peritonitis, parametritis, metritis, and thrombophlebitis.

A noteworthy modern warning was sounded by William Campbell, of Edinburgh, in 1822, when he stated in a *Treatise on Epidemic Puerperal Fever* that "During parturition we should avoid frequent examination and we ought on no account to interfere unnecessarily either for our own accommodation in consequence of the pressure of business or to please the impatience of the female herself, or her attendants."

In the early nineteenth century, many investigators thought that the inflammation of the uterus in puerperal fever did not originate in the membranous or muscular tissue but in its lymphatics and veins. Thus Dance (1826) attributed the primary rôle to an uterine phlebitis, while eight years later, Cruveilhier insisted that the trouble started in the lymphatics.

The opinion of the average physician of the time as to the contagious nature of puerperal infection is probably stated in the *Compendium of Midwifery* by Robert Gooch (1829) which was re-edited by Robert Skinner of Philadelphia and widely read in this country.

> The cause of puerperal fever is unknown; it is, however, generally believed to arise from some specific contagion: for my own part, I believe it sometimes occurs without an origin of this kind, as by common peritoneal inflammation, of which fever is the consequence; but there certainly is a disease of this kind which is infectious, and then it plays the very Devil; here the fever precedes the inflammation. Thus it is sometimes a sporadic disease, not

being infectious, and at other times the result of contagion; but in my own practice I have never seen the latter exemplified.

Gottfried Eisenmann (1834) made the important distinction that fever is the result of the disease rather than its cause. He stated "the disease poison attacks directly some accessible mucous membrane such as that of a wound (or of the mouth, throat, or lung) or of the pregnant uterus; and the poison produces a gelatinous softening or melting, with putrescence. The observation does teach us, however, that the fever is always the result of putrescence which has actually set in."

It is interesting to note in passing that this author recommended (1830) the use of instillations of chlorinated liquids into the eyes of the newborn to prevent gonorrheal conjunctivitis.

In the same year, James Blundell, of London, wrote

That the fever may occur spontaneously, I admit; that its infectious character may be plausibly disputed, I do not deny; but I add, considerately, that in my own family, I had rather that those I esteemed the most be delivered, unaided, in a stable, by the manger-side, than that they should receive the best help, in the fairest apartment, but exposed to the vapors of this pitiless disease. Gossiping friends, wet nurses, monthly nurses, the practitioner himself, these are the chambers by which the infection is principally conveyed (1834).

One of the first to speculate as to the transit of inflammation of puerperal fever from the uterus to the general peritoneal cavity was Robert Ceely, who, in 1835, wrote: "puerperal disease is erysipelas of the mucous membrane of the vagina and uterus, extending into the abdomen through the Fallopian tubes, and from them by contiguity and continuity of surface to the parts above described."

At this time, reports began to be published as to the results of disinfection of supplies and equipment. Robert Collins wrote of the experience of the Rotunda Hospital in Dublin where 10,785 women had been delivered without a single death from infection, subsequent to the establishment of a routine of thorough cleanliness and disinfection of wards, beds, etc., together with the cleaning of equipment with chlorine water. (1835).

In 1841, Rigby, while believing in several distinct types of puerperal fever, which differed in cause as well as effect, made the

following significant statement, " That the discharges from a patient under puerperal fever are in the highest degree contagious, we have abundant evidence." It had been previously suggested that the infection might be transferred from one patient to another but here is the first implication of the lochia as a means of such transmission.

Although a number of English authors had already stated their opinion that puerperal fever was frequently contagious, could be transmitted from patient to patient, and often was transmitted by the physician or some other attendant, the profession in general had been loath to adopt such an unattractive theory, and European and American obstetricians in general paid no attention to it. In 1843, Oliver Wendell Holmes published his famous monograph entitled *Puerperal Fever as a Private Pestilence.* Holmes seems to have contributed little to the current knowledge, except perhaps to draw attention to the frequent association of the presence of the physician in the autopsy room and the subsequent development of puerperal fever among his patients. His article, controversial in character and hotly contested by many of his colleagues, brought the problem sharply before the profession of this country for its consideration. Holme's premise was, " The disease known as Puerperal Fever is so far contagious as to be frequently carried from patient to patient by doctors and nurses." Further quotations from his treatise follow: " All forms of what is called puerperal fever may not be, and probably are not equally contagious or infectious." " I shall not enter into any dispute about the particular mode of infection, whether it be by the atmosphere the physician carried about him into the sick chamber or by the direct application of the virus to the absorbing surfaces with which his hand comes in contact. It is obvious that in the majority of cases it must be impossible to decide by which of these channels the disease is conveyed." He stressed the relation between puerperal fever and erysipelas and quoted cases of puerperal infection in a man's practice following his assisting at an autopsy, handling infected material in the surgery, or infecting his own hand. Among the recommendations as to prophylaxis, for there were none for cure, he suggested that the physician attending parturient women should never take any active part in the post-mortem examination of those dying of puerperal fever, and that

after merely being present on such an occasion he should bathe thoroughly, change every article of dress, and allow twenty-four hours to elapse before attending any case of midwifery. These precautions also held good for cases of peritonitis and erysipelas. Furthermore, the occurrence of a single case of puerperal fever should warn the physician that the next woman attended in labor was in danger of being infected by him and after two such cases he should give up practice for a month.

In 1855 Holmes wrote again repeating his views and refuting his critics. It is of interest that in this second paper he refers to one Senderein (Semmelweis) who had reduced the mortality from sepsis in his clinic by the use of lime water for cleansing the hands of the attendants.

The above treatise seems to have received very little notice outside the United States, where it became the subject of a great deal of acrimonious debate. Holmes' views were supported by many. Thus, Farr in 1843 wrote that, in his opinion, a certain number of deaths were caused every year by the contagion of puerperal fever, communicated by the nurses and medical attendants. A few years later, Lee stated flatly that " We conceive it unnecessary to go into detail to prove the contagious nature of this disease, as there are few, if any, American practitioners who do not believe in this doctrine." Moreover, Copland's *Medical Dictionary* (1852) stated: " boards of health, if such exist, or without them the medical institutions of the country, should have the power of coercing of or inflicting some kind of punishment on those who recklessly go from cases of puerperal fever to parturient or puerperal females, without using due precaution and who, having been shown the sick, criminally encounter it, and convey pestilence and death to the persons they are employed to aid in the most interesting and suffering period of female existence."

Nevertheless, many authorities, notably Hodge and Meigs, not only declined to accept Holmes' views but bitterly assailed him. In an address to his students Hodge said:

> The result of the whole discussion, will, I trust, seem, not only to exalt your views on the value and dignity of your profession, but to divert your minds of the overpowering dread that you can ever become, especially to woman, under the extremely interesting circumstances of gestation and par-

turition, the minister of evil; that you can ever convey, in any possible manner a horrible virus, so destructive in its effects, and so mysterious in its operation as that attributed to puerperal fever.

Meigs agreed with Hodge and added

I prefer to attribute them to accident, or Providence, of which I can form a conception, rather than to a contagion of which I cannot form any clear idea, at least as to this particular malady in the propagation of which they have no more to do, than with the propagation of cholera from Jessore to San Francisco, and from Mauritus to St. Petersburg.

Finally, the same principles were enunciated in 1846 by Samuel Kneeland of Boston who stated that "it (puerperal fever) could be produced by the innoculation of a woman with fluid from a sick woman or from the body of one who had died after labor, as well as from air vitiated by sick persons, especially when several women were together in a hospital ward, ill with puerperal fever." He also believed that infection could be carried by the physician, by clothes, or by anything that had been in contact with a woman already infected.

In Europe, little had been written up to this time in support of the infectious nature of puerperal fever. The year 1847 marked the beginning of the famous Lehre of Semmelweis. In the early months of this year, Semmelweis, who was an assistant in the first obstetric service of the Allgemeines Krankenhaus in Vienna, had been present at the autopsy of his colleague, Koletschka, who had died of septicemia from a cut sustained in an autopsy. Semmelweis says, "In the excited condition in which I then was, it rushed to my mind with irresistable clearness that the disease from which Koletschka had died was identical with that from which I had seen so many hundreds of lying-in women die. The puerperae also died from phlebitis, lymphangitis, peritonitis, pleuritis, and meningitis, and in them also metastases sometimes occurred." Moreover, he noted that his own ward, with a very high mortality, was used by students coming directly from the dissecting room whereas the second ward, with a much lower death rate, was given over to the instruction of midwives who had no such contacts. He further noted a cadaveric odor on the hands of the students and hence

In order to destroy the cadaveric material which adheres to the hands, I began about the middle of May, 1847, to employ chlorinated liquids, with

which every student was required to wash his hands before making an examination. Later a solution of chlorinated lime was substituted because it was not so expensive. . . . all seemed to justify the conviction that the hitherto unknown endemic cause of the frightful devastation which puerperal fever had wrought in the First Clinic had at last been discovered; it was simply the cadaveric material adhering to the examining hands in the First Clinic.

Later on, in the early summer of 1847, Semmelweis published Lehre I: "Puerperal fever is caused by the conveyance to the pregnant woman of cadaveric particles through the agency of the examining finger." Lehre II, presented in November on the same year, stated that "Puerperal fever may be caused by the conveyance of putrid particles derived from living organisms through the agency of the examining finger." One month later, Lehre III: "Puerperal fever may be conveyed to the pregnant woman subsequent to delivery by foul air loaded with exhalations from putrefying animal matter, the putrid material finding its way through the air to the genitalia." It may be noted, at this point, that references to the importance of a foul odor are frequent in Semmelweis' writings. In his opinion, there was a constant connection between this odor and infection. Nowhere does he believe that material without a foul or putrid smell could carry infection. Ten years elapsed before the appearance of Lehre IV (1857) and at this time Semmelweis was in Buda-Pesth. "Puerperal fever may be conveyed to the lying-in woman by the foul bed clothes, dressings, and sponges, and by the hands of midwives and nurses." Shortly after this time, and not as a major fact, he published the new and significant idea of autoinfection. In rare cases, "owing to the retention of organic matter which should have been expelled in childbed. Before its expulsion decomposition has already begun and when absorption occurs puerperal fever is induced by self infection. The organic materials are the lochia, remnants of decidua, blood coagula which are retained within the cavity of the uterus." Furthermore, "forcible use of forceps, causing gangrene or bruised portions of the genital organs may cause child-bed fever by self-infection. . . . Puerperal fever is not a species of disease; puerperal fever is a variety of pyaemia." Semmelweis denied that puerperal fever is contagious in that it can produce a contagion which in turn would produce the same disease in another individual. "But puerperal fever is conveyable from a sick pregnant, parturient,

or puerperal woman to a healthy one by means of a decomposed material produced by the (former)." Finally, we have Lehre V stating " (a) Puerperal fever may be conveyed to a woman subsequent to delivery through the presence in the same hospital of surgical cases producing putrid products. (b) The puerperal woman may also infect herself owing to the retention within the birth tract of material which has undergone decomposition. (c) Instrumental injuries, bruising or causing gangrene of the genital tract, may produce puerperal fever by self infection." In 1861 he said: " The conveyer of the decomposed matter may also be the atmospheric air. Hence, free ventilation is necessary to carry away from the lying-in wards the exhalation of patients before they can form a puerperal miasma. It is also essential for the welfare of patients in a lying-in hospital that several rooms for isolation be provided so as to promptly separate infected from normal puerperae."

Semmelweis' writings stirred up in Europe a debate like that going on in America over Holmes. He had many supporters but was also bitterly challenged by some of the most prominent members of the profession. It has been frequently stated that this acrimonious debate had much to do with his mental upset and subsequent early death in 1863.

To students of medicine, Semmelweis' name has occupied the highest position among investigators of puerperal infection and that great credit is due him cannot be denied. However, on careful analysis, nothing that Semmelweis said concerning the etiology and mode of spread was new except Lehre I. The general doctrine had previously been advanced by others, notably White, Kirkland, and Collins in England, and by Holmes and Kneeland in America. Undoubtedly Semmelweis is responsible for directing continental thought along these lines, but it seems fair to give other pioneers priority, at least in other countries.

In passing, there should be noted the name of Fleetwood Churchhill who, in 1849, under the title of *Essays on the Puerperal Fever and Other Diseases Peculiar to Women* published a brief history of the condition together with an interesting account of various epidemics.

In 1850, Sir James Y. Simpson drew specific attention to the

similarity in the causative factors of puerperal fever and so-called surgical fever. It was his custom before attending a lying-in woman to wash his hands in a solution of potassium iodide and his policy of disinfection drew numerous adherents. Lister, in 1865, performed a surgical operation under antiseptic conditions. It is generally believed that J. J. Bischoff, of Basle, Switzerland, a few years later became the first to apply Lister's teachings to midwifery (1876).

The next advance toward the solution of the etiology of puerperal infection was the establishment of knowledge concerning its bacteriology. Rokitansky in 1864 reported that he had found germs in the lochia of cases of puerperal fever and when these discharges were injected into the bodies of experimental animals abscesses developed. The next year Mayrhofer published the observation that chains of micrococci could be found in the tissues of various organs of women dead from puerperal fever. In 1880, Pasteur cultivated for the first time the streptococcus from the organs of such cases. In 1889, Widal demonstrated that the streptococcus was to be found in all types of puerperal infection, including edometritis, parametritis, peritonitis, septicemia, pyaemia, and even phlegmasia alba dolens. Other organisms were subsequently found in pure culture in the occasional fatal case, among them the staphylococcus by Brieger in 1888, the gonococcus by Kronig, the colon bacillus by von Franque and the tetanus bacillus by Heyse, all in 1893.

Meanwhile, Ahlfeld in 1883 had revived the problem of autoinfection. Semmelweis believed in its possibility but as he postulated the condition it could not occur. Ahlfeld postulated that "it is quite possible that pathogenic organisms may exist in the genital tract during pregnancy without giving rise to any symptoms whatever, and only exert their influence during labor or the puerperium, when the wounds which follow labor will afford abundant opportunity for their absorption. Strength was given to this view by Döderlein in 1887 and Winter in 1888 who found varities of streptococci and staphylococci in the vagina and cervix of non-pregnant women. Later, Whitridge Williams found pus-producing organisms in the lower genital tract of pregnant women. This author concluded that "auto-infection should frequently occur but practically

it is of comparatively rare occurrence." This about expresses the present status upon the subject although many controversial papers have appeared.

During the present century the subject of puerperal infection has been a popular one with obstetric writers generally but in so far as etiology is concerned most of them consist of amplifying and clarifying knowledge already extant rather than presenting new points of view. It would seem that more has been accomplished in recent years in the prophylaxis of the disease than in its etiology, pathology, or treatment. This advance is chiefly in terms of the application of the rigid technique of the surgical theatre to the delivery room, and popularization of examinations per rectum instead of the more dangerous vaginal route. As was stated earlier, the problem is far from completely solved despite the endeavors of the most brilliant medical minds throughout the century past.

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RELIGIOUS MOTIVES IN THE MEDICAL BIOLOGY OF THE XVIITH CENTURY *

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III

Against what type of reason and science is the new demand for empiricism directed? The answer to this question is supplied by one of the principal documents of the Order of the Rosicrucians, the "Themis aurea" of Michael Maier, physician to Rudolph II.[1] It is chiefly that type of reason which, like Galen, in his well known tables on the effects of remedies, desires to calculate and explain the properties and actions of substances from their qualities. The specific element of the remedy, that is, the unknown part which operates, the "proprietas" of Paracelsus, exercises its function directly ("immediate").[2] This function of the remedy is its form or idea and is identical with the ideas of all the other things

* See *Bulletin of the Institute of the History of Medicine*, vol. III, 1935, no. 2, pp. 97-128.

[1] See Craven, J. B., *Count Michael Maier, Doctor of Philosophy and Medicine, Alchemist, Rosicrucian, Mystic*, 1910 (quoted after Waite, A. E., *The Brotherhood of the Rosy Cross* (London, 1924). Mich. Maier lived from 1568-1622, the title of his paper is: "Themis aurea h. e. de legibus fraternitatis R. C. tractatus, quo earum cum rei veritate convenientia, utilitas publica et privata, nec non causa necessaria evolvuntur et demonstrantur" (Frankfurt, 1618).

[2] "Proprietas est quaedam virtus vel naturalis positio continens immediate et inseparabiliter formam substantialem rei adductam super ipsam sub determinata proportione adiuvante coelesti influentia." V, p. 47. This conception of "Proprietas" is in many respects identical with that of the ὕλη οὐσία of Galenos, and it is from this doctrine that Haeser derives the medical belief in magic and supernatural forces (*Geschichte der Medizin*, 3. Edition, 1875, p. 357). On the other hand the practical value of this doctrine was not very high within the system of Galenos (compare his "de renum affectionibus," previously mentioned, further III, simpl. med. 12; *ibid.*, V, 18 — comparison of the proprietas with the virtue of the magnet — and particularly the treatises on "Theriac" in the XIVth volume of Kuehn's edition of Galen's *Opera omnia*. Avicenna repeats the comparison with the magnet ("Sicut est in magnete virtus attractiva ferri, quam nulla elementariarum virtutum invenitur habere." Canon, Tr. 2 de vir. corp. Venet. Junt. 1608, vol. II, p. 340). Accordingly Averroës recommends experiment rather than syllogism in order to find out the "Complexio medicinae" ("Sciuntur per rationes, sed verificantur experimenti." A "Compositum per rationem" should not be given to a noble patient unless it has been proved harmless in a peasant with strong constitution. Super Cantic. Avicennae. In the Edit. of the Colliget Venet. Junt. 1553, p. 104 and De theriaca. Venet. Junt. 1552, p. 141.

of the world, and likewise dependent on the influence of the stars. These are the shining signs of divine law, immutable and inaccessible to intellectual analysis, but apprehensible by means of experiment.

The true physician learns the properties of remedies by means of " ratio experimenti " alone.[3] Accordingly he selects " pauca probata infallibilia," mixes them deliberately (" iudicio "), not in order to give the impression of a longer prescription, but to ensure that they are actually suitable, and that his estimate of their action is correct. The " Proprietas " has nothing to do with the complexion, which was the sole object of investigation by the ancients. For things of different complexion can have the same effect. Rhubarb and tamarinds " a tota proprietate " attract black bile, but they are not of the same complexion. Whereas the complexion is deduced by rational calculation, the proprietas is obtained by experiment. Hence from the opposition to automatic reason results the preference for empiricism and experiment.

It is in this sense that Suchten[4] emphatically states that he will describe only that which he knows " exacte et certe," which his own eyes have seen, his own hands have touched, and experience confirms; but this is entirely for the benefit of the young who are not yet contaminated by doctrines and opinions, and not for the followers of Galen, because they pretend to discover more secrets in nature than ever existed, and not for the followers of Paracelsus, because they claim that the knowledge they have obtained from their master is greater than that of the author himself.

How is this experience to be achieved? The necessary work is done by chemistry, which separates the superfluous matter from the essential nucleus, thus creating medicines of greater purity than are otherwise to be obtained. Therefore there is already a new science appearing in place of the old.

True medicine is the gift of God, only to be obtained by the devout and worthy, whose human reason is illumined by God, while pride is allied with ignorance. The physician must be " born by the light of grace and nature, by the internal and invisible angel in man, in

[3] " Multa stant in experimento quae nunquam fuere nec de praesenti stant in ratione," p. 47.

[4] *De secretis antimonii*, 1570. Ed. Forberg latine (Basil, 1575).

the light of nature which instructs man like a true preceptor." [5] Thus, there develops a peculiar conception of nature. Nature is defined first of all by her relation to God to whom, as His workshop, she is subjected; and secondly by her relation to men to whom she appears as part and product of the Divine. Hence knowledge resulting from the investigation of nature is the beatitude of the present life. Theology is the natural and supernatural source of science.[6] Therefore the heathen writings on nature are almost always wrong; it is a waste of time and diligence to seek wisdom there.[6a] Authorities like Galen and Aristotle are not to be acknowledged. Every sect [7] is based on some element of truth. The physician who wishes to excel must therefore abstain from sectarian doctrines. Experience alone enables him to detect the errors of the ancients and to elucidate all that is occult, and thus to fulfil the ordinance of God. The knowledge of sympathy and antipathy as the results of divine providence, the signs of the macrocosm, chiromancy and physiognomy lead to a medical science which God has miraculously inscribed in the book of nature, i. e., in the heavens and in the earth. The human soul, by a mystic process of internal contemplation and reversion to itself, attains to "mens," and hence it approaches God, seeing all without need of external instruction, a mysterium incomprehensible by the "spiritus academicus." [8] This is the illumination of reason by the mens, a state which is due to the Divine Right, while the perception "per sensus" includes a removal from God. On the other hand, only the physician who prepares remedies with his own hands and not by "ratione" like the

[5] Crollii, Oswald, *Basilica chymica cum notis Hartmanni et praxi chymiatrica* (Marburg, 1611), pp. 6, 11, 13, 28.

[6] It is therefore described in the "Themis aurea" as characteristic of the Rosicrucians that they live for godliness, search the scriptures and practise mercy and holiness without thought of reward. But immediately after this there follows the statement that they investigate "omnem naturam," making the secrets of nature the basis of experiments ("eiusque arcana in experimenta ducunt"). They are in possession of many of these secrets in astronomy, physics, mechanics, medicine and chemistry, all fundamentally true, by means of which they work wonders. Finally, Nature allows her processes to take their course according to her own laws, in the operations of which only God in his providence can interfere.

[6a] Compare Roger Bacon's entirely different appreciation of the ancient authors in the I. chapter of this paper.

[7] According to Pico della Mirandola. Croll, *ibid.*, p. 65. [8] P. 71.

" medicus rationalis " and who knows how to separate the remedy from the poison and to reduce composite substances to their " pure simplicity " [9] is the genuine physician.

But nature which we are investigating is " ministrans," that is, the servant of the independent Creator. She proceeds in her allotted task " fideliter et naturaliter." Her work can bring man good or evil, and under these headings come disease, healing and death. They are provided by God for every individual, and this providence of God changes nothing in the natural course of events, " sed cursum sinit naturae ordinatum." Nevertheless Divine Will in its absolute independence has also power to operate against the destined course of nature and to interrupt it sometimes " nunc in his, nunc in aliis emendando et derogando." [10] The evil to which a man is doomed " secundum naturae ordinem " is allowed to take its course as this man's punishment which binds him to the earth, to the causal, compulsory course of natural events.

The secrets of nature, to which the true divine medicine leads, represent the development (" explicatio ") of God and therefore accomplish what is known as " ars magica." [11] Magic, in this sense, is the highest, the most perfect and the richest knowledge of " philosophia naturalis." It is assisted in its wondrous works by profound experience and the occult virtues of things, which, applied to a suitable substratum, perform miracles in the natural course of events (" rerum natura "). [12] Thus the magician is a particularly

[9] Pp. 77, 4.

[10] Compare the well known doctrine of St. Augustine (De gen. ad lit., IX, 17; V, 23; III, 14, etc.), and the view-point of Robert Boyle at the end of this paper.

[11] Maier, with reference to the divine origin of magic, quotes: *Origines* 5, tract. sp. Math.; 23 Hom. sp. Numeri. Further Philo, Jud.; *Περὶ τῶν ἀναφερομένων ἐν εἴδει νόμων.* Opp. ed. Adr. Turnebus (Colon, Allobrog. 1613), p. 611:

" Vera magia h. e. perspectiva scientia per quam opera naturae clarius cernuntur." Compare with this conception of magic that outlined by Thorndike: " A way of looking at the world which is reflected in a human art . . . employing varied materials in varied rites often phantastic to work a great variety of marvellous results which offer man a release from his physical, social and intellectual limitations, not by the imaginative and sentimental methods of music, melodrama, fiction and romances or by religious experience or ascetism, but by operations supposed to be efficacious here in the world of external reality." *Loc. cit.*, II, S. 974.

[12] See Gaffarel, James (1601-1681, librarian to Cardinal Richelieu), *Unheard-of curiosities concerning the talismanical sculpture of the Persians, the horoscope of*

diligent student of nature, who is equipped with an extensive knowledge of her works and possibilities. Now if, at the right moment, he unites the active with the passive, he can obtain such premature effects as appear miracles to ordinary people, although he has achieved nothing more than an anticipation of time in the natural course of events. Thus there are always wonders in the world accessible for discoveries and inventions, so that continual progress is possible, while the needs of men increase proportionately. Nobody would have suffered if printing had not been invented.

This relation to magic which originated in the ideas of the Renaissance (Picus,[13] Paracelsus) has ruled the thoughts of religious scientists and physicians during the XVIIth century.[14] The example of Sir Thomas Browne, who believed in witchcraft, shows the possibility of a via media. He recognizes magic as a revelation of "honest effects of nature" and admits on the other hand that magic was originally conceived by the devil and by spirits which may or may not be evil. "Thus, I think, at first a great part of philosophy was witchcraft; which being afterwards derived to one another, proved but philosophy." That which we discover as "philosophia naturalis" is magic if it is taught by the devil or spirits.[15]

the patriarch and the reading of the stars. Transl. i. Engl. by E. Chilmead (London, 1650): Amulets etc. should be made under certain constellations, "as that they shal have the power, *naturally* and without the aide of any demon or divel, to drive away noisome beasts, allay winds, thunder and tempests and to cure diverse kinds of diseases." — The treatise of Gaffarel contains a vindication of the Jewish and rabbinic writings which are much less dangerous than those of the heathen, allowed by the Fathers, and a refutation of the arguments against the Aristotelian doctrines.

[13] According to Inge, W. R., *Christian mysticism*, 7. ed. (London, 1933), p. 269, Pico regards magic as the "deepest mysteries and the knowledge of the whole of the nature with her powers."

[14] Further, to express it paradoxically, exaggerated scepticism could be a source of belief in magic and witchcraft. By his utmost scepticism as to the traditional Aristotelian methods as means of natural research Joseph Glanville was led to a vigorous defence of the belief in witchcraft, a fact which has been pointed out by Jos. Needham, *The Sceptic. Biologist, loc. cit.*, p. 196. According to Glanville there was not any valid argument against magic and witchcraft, because of the "vanity of dogmatizing and confident opinions."

[15] Sir Thomas Browne's *Religio medici*, ed. W. A. Greenhill (London, 1898), I, 31, p. 51 ff. For Browne's attitude to magic and witchcraft compare the excellent account of Sir Humphry Rolleston, Sir Thom. Browne, *Annals of Medic. History*, N. S. II, p. 7 ff., 1930. See also Jos. Needham, *Scept. Biologist, loc. cit.*, p. 195.

Even Francis Bacon recommends the trial of magic, "si forte subsit et lateat in aliquibus eorum aliqua operatio naturalis," as influences from body to body and spirit to spirit.[16] Although magic is overloaded with superstition and imposture, there remains a certain number of "consensus" which are proved by reliable experiments, e. g., the consensus — by virtue of their "occult" and specific powers[17] — between the magnet and the iron, between mercury and gold, between certain remedies and individual parts of the body, humours, diseases. Where great effects are produced by substances or virtues, inadequate according to their quantities, there occur "Instantiae magicae," i. e., examples of magic.[18] Such effects are produced by a specific poison, that is to say, a toxic substance, whose effects are invariably the same.

On the other hand we find in the official ecclesiastical viewpoint as represented especially by the Jesuits (*Del Rio*)[19] a kind of liberalism which refutes magic. This attitude is expressed in a book by Joh. Freitag[20] on the occult side of medicine. The treaty with the

[16] *Nov. Organum*, II, 31; *De augment. scient.*, IV, 3.

[17] *Nov. Organum*, II, 50.

[18] *Ibid.*, II, 51.

[19] About del Rio, see Pagel, W., *Joh. Bapt. van Helmont*, Einfuehrung in *die philosophische Medizin des Barock* (Berlin: Springer, 1930), pp. 93 and 99.

[20] Noctes medicae s. de abusu medicinae tractatus, quo universum medicastrorum examen empiricorum modernorum uberrima annona, uromantes s. lotiophysici . . . dentifrangibuli chirurgi genethliaci . . . myropolae pseudochymici, umbratici doctores Paracelsistarum sectae, magomedicastri, sagae et superstitiosam vulgo curam exercentes perstringuntur, de magia vetita et magorum suppliciis agitur, artis Paracelsicae fundamenta luculenter traduntur . . . et evertentur. Francof., 1616. Against empiricism and experiment: Cap. 5, "Experimentorum plaustra non facere artificem nec per solam experientiam addisci artem medicam." Galen's doctrine of humours and tempers explains more clearly biological facts such as the alteration of the character by the food, etc. The specificity of a remedy, its virtue, does not exclude humoralism. There may be sympathy or antipathy between the substance and one or the other of the humours. Thus the doctrine of sympathy and antipathy is applied to humoralism. Similarly, in the writings of Sennert and other contemporary authors, the new alchemy and the doctrines of Paracelsus are regarded as "ministra et famula" of the galenic, that is to say, rational medicine, e. g., in Christ. Horn, *De auro medico philosophorum*, i. e., de illo occulto salutari solari omnium mineralium vegetabilium et animalium corporum spiritu s. balsamo vivifico . . . dialogus scholasticus. Francof., 1615. With reference to Sennert's attempts to reconcile humoralism and the doctrines of Paracelsus, see Pagel, *loc. cit.*, p. 61. Compare the liberalism and scepticism of some medieval physicians regarding magic and sorcery as opposed to the official ecclesiastical dogma, which declared

devil is here accepted as the basis of all magic, and on the grounds that lunatics have never been known to make a compact with the devil, the author refutes the theories that witches are lunatics. A Christian must therefore prefer death to healing by magic procedures.

According to Freytag the only disease that gold will cure is covetousness. "Ars non adaequat naturam." The alchemist can not produce a droplet of blood artificially, but only a reddish liquor. He cannot make any "homunculus extra naturae ordinem a deo institutum atque coniunctione maris et foeminae fecundorum." The art of the alchemist is opposed to nature and therefore blasphemy.

Here we find the same contrast drawn between "Naturalia" and "Artificialia" to which Quercetanus [21] objects, when he, Quercetanus, maintains that the true chemical art must be founded, "quae naturam ipsam imitando metalla, transmutet."

Thus the art of chemistry is an "Opus naturale," if matter itself is a part of nature, because "decoquendo appetit, retinet, digerit, expellit, permiscit, corrumpit, generat et informat suo tempore lapidem cum quo natura informat metalla per ipsam permixtionem." And all that occurs "praecepto Dei omnipotentis." [22]

On the other hand, chemistry is also an art, not because art creates, implants and destroys forms, but because it serves nature in its efforts to make gold by such an indirect process as occurs when gold develops from base metals. The art of chemistry is able to imitate that natural process, but, unlike nature, is unable to produce gold directly.

common and natural processes and any disease under unusual circumstances as devilish trickery and work of demons: Diepgen, *Die Daemonen — und Zauberkrankheit bei den Theologen und Medisinern im Mittelalter.* Naturforscherversig. (Nauheim, 1920). Janus., XXV, 1921, p. 112. — On the other hand, compare: Fehr, Joseph, *Der Aberglaube und die katholische Kirche des Mittelalters* (Stuttgart, 1857), illustrating the combat of the Catholic Church against heathen superstition.

[21] Jos. Quercetani, *Opera medica. ad J. Auberti de ortu et causis metallorum contra chymicos explicationem brevis responsio* (Lyon, 1591), p. 55.

[22] See also the *Diaeteticon polyhistoricon* of Quercetanus (Paris, 1606). The whole world, and man especially, demonstrates a deviation from "nature" ("Res a natura sua degenerarunt"), due to the sin of Adam. The degenerated, that is to say, unnatural things, are harmful for men, but God, by revelation of the Christian science of alchemy, has enabled man to become wise and to help mankind (p. 6 v.).

In conclusion: As a result of their scepticism with regard to the existing science as well as their religious convictions, and on the basis of their refutation of Galen's doctrine of qualities and humours, alchemists, such as Mich. Maier, the Rosicrucians, Suchten, Croll, Quercetanus, embarked on a course of independent empirical research. Their point of view is partly due to a positive appreciation of magic as a systematic imitation of nature by means of arbitrary variation of the conditions of natural processes.

On the other hand, the official deprecation of magic (Jesuits — *Del Rio* — Freitag, etc.) is united with a revival of humoralism and the rational explanation of natural processes by means of the ancient qualities. The procedures of alchemy and of "nature" are, according to these trends of thought, entirely different and incompatible. Hence the art of alchemy is blasphemy and imposture.

IV

The conception of the world underlying the trends of thought described here is monistic. Things corporeal and things spiritual are connected in a graduated cosmos leading upward to God himself. The symbol of this transition from the finest corporeal to the spiritual, the intermediary between the two worlds, the beginning of all things, according to the tradition of the Pentateuch, is light. Light penetrates matter, giving it origin and form. "It animates all things, contains all things, supports all things, brings all things together, unites all things, it separates all things, it draws all things to itself; all that is, or is illumined, or is warmed, all that lives, or all that is created, or is fed, or is increased, or is perfected, or is moved. It purifies whatever it has transformed. It perfects all things, it renews all things, it preserves all things and protects them from annihilation. It is the number and measure of all things." Light is the image of the Deity, the world its coal. The terrestrial bodies gain in beauty and perfection according to their degree of participation in the light. Thus Franciscus Patritius in his metaphysics of light, his "Panaugia," sings of the world, which is entirely animated by the power and virtue of light.[1]

[1] Patritius, Fr., *Nova de universis philosophia* . . . in qua aristotelica methodo non per motum sed per lucem et lumina ad primam causam ascenditur . . . quibus

The rays are the messengers of light which accomplish all things. The rays of God are, according to the hermetic book, the realizations (ἐνέργειαι). The rays of the cosmos are the elementary properties (φύσεις), the rays of men the arts and sciences.[2]

Robert Grosseteste regards all activity in nature as dependent on raylike lines, angles and figures, and their reception by the surface of the substratum (reflexion or refraction).[3]

We may call the agent "Species" or "Similitudo," we can imagine its transmission from one body to another only by means of lines, angles and figures, which like rays are absorbed or reflected in a manner which varies according to the state of the surface and translucency of the object. The shorter the distance between the object and the agent, the shorter the rays and the more intensive the effect. Rough surfaces with unequal parts destroy the rays or diminish their force. All natural activity varies in intensity according to the differences in the lines, angles and figures. All unity comes from the perfection of light, all multiplicity from its division.[4]

Roger Bacon, in his "Perspectiva," [5] devotes an entire chapter to the importance to the health and disease of men of the "Multiplicatio virtutum," as the result of lines, angles and figures. Both the hidden and the manifest occur according to the "mira potestas huius multiplicationis." In order to preserve health we must endeavour to avoid harmful influences from without, at least, we must try to avoid their direct action, which is caused by the radiation of rectilinear rays, even if we are unable to escape the

postremo sunt adiecta Zoroastris oracula CCCXX ex Platonicis collecta, Hermetis trismegisti libelli et fragmenta, Asclepii discipuli tres libelli, Mystica Aegyptiorum a Platone dictata, ab Aristotele excepta et praescripta philosophia (Venet., 1593). I Panaugia (De luce. de diaphano, de radiis, de lumine, de opaco).

[2] *Hermetis trismegisti clavis*, Lib. IV; Patritius, *loc. cit.*, *Hermes trismegist.*, Lib. XII.

[3] Libellus Linconiensis de phisicis lineis angulis et figuris per quas omnes acciones naturales complentur (Norimbergae, 1503). Frontispiece: Radius reflexus and Radius fractus.

[4] "Omnia esse unum ab unius lucis perfectione. Ea quae sunt multa, esse multa ab ipsius lucis diversa multiplicatione." De luce s. de inchoatione formarum. Baur, L., "Die philosophischen Werke des Rob. Grosseteste," *Btrge. Gesch. Philos. Mittelalter*, 9 (Münster, 1912), p. 51 ff.

[5] Ed. Joh. Combach (Francof., 1614); *Spec. mathemat.*, p. 16; p. 49; Cap. 6, p. 61.

broken or reflected rays. Thus the rays of the sun bring death in summer and those of the moon at night. Saturn and Mars cause great harm, imparting the germ of corruption to things " ut experientia docet." The contagious diseases develop when a species contracted in unclean places increases (" multiplicatur "). The same emanation and increase of a harmful " species " occurs when a woman during menstruation, by her presence or glance, clouds a mirror, and when a man " malae complexionis " has an evil influence on his fellows.[6] The facts included in the " Perspectiva " agree with the wisdom of the Bible and therefore are of use to mankind.

Just as the light and the beams of the sun break through after driving away the clouds, according to Alfredus Anglicus,[7] the finest parts of the blood are animated and changed into " spiritus " within the heart and the arteries, when the life-giving warmth, by virtue of its expansion, opens the outlets of the blood and radiates through all the channels. Like the sun, the heart emits the beams of its virtue (" primae virtutis actum ") thus distributing vital force all over the body.[8]

There are many paintings depicting St. Francis receiving the " stigmata." These pictures show Christ appearing to the Saint with rays passing from His wounds to the corresponding parts of St. Francis' body. The painters have demonstrated the course of the rays in a naturalistic manner.[9] The idea of influence being conveyed in rays of light is common in XIIIth century paintings (Dorothea Singer).[9a]

[6] Compare the " spiritus " and " vapores " which according to an ancient tradition, reviewed by Arnald of Villanova, transmit influences from one person to another (Arnald, *De parte operativa*).

[7] " De motu cordis," ed. Cl. Baeumker, *Beitr. Gesch. Philos. Mittelalt.*, XXIII, 1/2 (Münster, 1923), XI, 3, p. 46.

[8] *Ibid.*, VIII, 3; XVI, 17, p. 94.

[9] See, e. g., Musée du Louvre, 1312 (or Firenze Gal. ant. e mod.): Giotto, *St. François recevant les stigmates*. Cf. the collection of pictures made by Facchinetti, V., *Le stigmate de S. Francesco d'Assisi*, 1924; and *San Francesco d'Assisi nella storia, legenda, arte* (Milano, 1921). — In the pictures of Guercino, Baldachio, Macrino d'Alba, etc., the beams are missing, in the pictures of Tintoretto, Foppa, Cardi they are only outlined. Similar to the conception of Giotto are the pictures of Duerer, H. Fries, and one of the Scuola Umbro-Fiorentina (copied in the book of Facchinetti).

[9a] Personal communication.

The wisdom of the world is knowledge and cognition. All cognition has its origin in the mind, being primarily derived from the

GIOTTO: SAINT FRANCIS RECEIVING THE STIGMATA. Paris. Musée du Louvre Nr. 1312. Naturalistic conception of light beams transferring celestial influences.

senses. The most important among these, on account of its subtlety and power, is sight. It was the first to experience light. By the aid and effect of light we are able to differentiate what is above from

what is below or what is in the middle. Sight is succeeded by wonder, wonder by speculation, and speculation by philosophy. Philosophy, is therefore the legitimate descendant of light, of illumination, of wonder, and of contemplation. Light is simple, unity before multiplicity, the singular number before the division into two. Therefore it is in close connection with the Divinity, spiritually the image most resembling Him, physically His reflection in the mirrors of the stars. Thus light is the mediator between the Deity and material nature.[10]

The wonders of light are here regarded as metaphysical entities and are connected with each other in a general sense. If, however, man is the microcosm who, as one degree of its development, reflects the macrocosm, the study of optics promises to reveal laws which govern both the origin of things and the nature of man. The development of parts in a whole, wherein the integrity of the whole is preserved, appears to be strikingly illustrated by light and the laws of its transmission. Thus it was the metaphysical conception of the significance of light which may have stimulated the scientific study of the problems of physical optics. By means of the application of the principles of optics Marcus Marci of Landscron attempted to solve the problem of the origin of man.[11] His importance to the

[10] Patritius, *loc. cit.* A source of these doctrines typical of the XVIIth century is Comenius, according to whom light works up matter by loosening, warming and lightening it, whence all qualities are derived (*Physicae Synopsis*, Cap. II ed. Reber. Giessen, 1896, p. 88 and Addenda, *ibid.*, Cap. 5: "De primo omnium in mundo motore, luce s. igne," p. 420).

[11] Marci, the "Bohemian Plato," the "Hippocrates of Prague," was born 1595, studied 1610-24 at various Jesuit colleges and at the Prague University; 1627 he was appointed professor; 1647 physician to the Emperor Ferdinand III and "physicus senior" of Bohemia; 1654 "Pfalzgraf" with the title "Von Kronland"; 1662 Rector of the Prague University. He died in 1667. From his early youth he was accustomed to overtax himself and his weak bodily constitution. He wrote about sixteen books, e. g., the *Idearum operatricium idea* (1635), the subject of discussion; *De proportione motus figuram recte linearum et circuli quadratura ex motu* (1639), *Thaumantias, liber de arcu coelesti* (1648), *Philosophia vetus restituta* (1662), etc. See Biography in his *Liturgia mentis s. disceptatio medica, philosophica et optica de natura epilepsiae* (Ratisb., 1678), edited by his scholar, J. J. Wenc. Dobrcensky de Nigroponte. Further: Guhrauer, *Marcus Marci und seine philosophischen Schriften*; Fichte-Ulrici'sche, *Ztschr. f. Philos. u. philos. Kritik*, XXI, 241, 1852; Hasner, *Prager Ztschr. Heilkde.*, IV, 170, 1883; Hoppe, E. M., "Ein vergessener Physiker des XVII. Jahrhunderts," *Arch. Gesch. Math.*

progress of science is due to his work in physics, particularly in optics. In connection with the latter he successfully studied the division of light into colours and anticipated Newton's "experimentum crucis" by proving the homogeneous nature of the coloured rays (Hoppe).[12] Here a science is developing on the lines employed by the exact experimental scientists of a later era. This author is of special interest to historians of medicine and biology, because, in these spheres, he combined experimental investigation with an abundance of mystical and philosophical conceptions which could not fail to give impulse and colour to his scientific work. This combination of scientific method with mysticism gives him an intellectual and historical position similar to that of Helmont, to whose doctrines of archei and ideas he adheres, while his general application of the laws of light and radiation in all spheres, even of the animate world, places him among the light-mystics. Reference to his work is appropriate, as in it mystic philosophy is closely allied with a tendency towards exact science. At the same time, like so many of his scientific contemporaries (Harvey, etc.), he is emphatically a disciple of Aristotle. Nothing, however, shows the union of mystical and religious ideas with a mechanistic and scientific point of view so clearly as his "Idearum operatricium idea," a never completed pamphlet which contains his *speculative embryology, based on optical conceptions.*

The work first of all deals with the nature of the semen. Marci rejects, as too materialistic, the ancient hypothesis (Democritus)[13] that the semen is derived from all parts of the body. As a matter of fact, it is not a part *of* the body, but is attached *to* the body as something independent following its own inherent idea. If the semen were a mosaic of the products of the individual parts of the body —

Natw. Techn., XXX, 1/2, 1927; Lehmann, E. M., "Gesundheitsbuechlein," *Anhang zur Otosophie* (Landskron, 1928).

[12] "Refractio superveniens radio colorato non mutat speciem coloris" (Thaumantias, 1648). See Hoppe, *loc. cit.*; cf. also his doctrines in mechanics, theory of motion, importance of elasticity, on the pendulum, etc. Further, Hauessler, *Mitt. Gesch. d. Mediz. u. Natwiss.*, XIV, 165, and against the over-rating of his achievements: Rosenfeld, L. M., "Untersuchungen ueber das Prisma und ihr Verhaeltnis zu Newtons Farbenlehre," *Isis*, 1931, XVII, p. 325.

[13] Agrippa of Nettesheym had taken the numerous divergent theories of the ancient authors on the origin and importance of the seed as the proof of the uncertainty of scientific medicine. *De incertit. et vanit. scient*, Cap. 82; *loc. cit.*, p. 428: *De medicina in genere.*

who should save the germ from becoming a confused chaos? The essential part of the semen is the independent epigenetically plastic "vis efficiens."

In the presumably vaporous material of the semen the soul-like force first of all designs the *whole picture* of the child to be, making a shadowy outline, not only of the exterior, but also of the internal parts. Therefore, before the existence of the individual members there is a peculiar model of the whole, composed of the most delicate substance. Between this stage of development and its completion in matter another intermediate species must exist. The work of this is to ensure the achievement of the idea, e. g., that a human being and not a man-like stone is formed.

The semen is fundamentally different from a machine, being related to living things, even though it is itself without the attributes of life, such as movement, feeling, alimentation. In the engine the result is exactly equivalent to the motor force put into it; in organic reproduction the result, that is to say, the soul of the new individual, is very often quite different from the soul of the parent.

Like the soul, the semen is immortal. This is evident from the existence of spontaneous generation, an event which occurs probably on account of the great surplus of semen formed. According to all experience, a small part of the semen suffices for reproduction. Obviously it is *monadically* constructed. Its entire virtue must be contained in its *smallest* parts, for as a shattered mirror breaks up the original single image into numerous small ones, so the semen, when broken into fragments, also has numerous centres, and this makes it evident that even a small portion of the semen can produce one or more embryos.

The soul-like vegetative principle in the semen forms the future character, transmitting resemblances and hereditary sins. The statement that all mankind sinned in Adam is explained by the fact of the enclosure ("Einschachtelung") of all living beings in Adam's seed. In addition to this "anima brutorum," which is contained in the seed from the beginning, there appears, at a later stage, the immediately divine "anima rationalis." It is the task of the vegetative soul to unite the corruptible matter with the immortal anima rationalis, the "vera hominis forma," wherein the individual returns to unity, the Many to the One and the realization to the idea.

How does the plastic force work in the semen? It is not entirely autonomous. Absolute epigenesis does not exist. On the contrary, its procedure is dependent upon the already traced outline of the whole. The plastic force works in "imo corporis recessu," in a geometrical centre of the future body corresponding to the heart of the true Aristotelian tradition. It operates "absque tumultu et instrumento," is worthy of the highest admiration, since the living being, in exquisite perfection, provided with numerous members and dissimilar parts, results from a single homogeneous entity. The time required for the work in the construction of the different parts is the same, for the "vis plastica" does not first draw an outline of the form and then complete the details in turn, but it activates regularly in all spheres. If the embryo be represented as consisting of concentric circles, the plastic force operates very slowly in the inner smaller circles in order that, even in the outermost circles, the whole process may be completed at the same time. Thus the force must be equally distributed, "esse totam in toto et totam in qualibet parte." [14] This theory of regularity is based on the assumption that the position of all parts has been previously determined; otherwise the same force could not form brain at A and liver at D. That it does not form brain also at D is due to the existence of the ideal outline of the organ contained within the general sketch of the whole organism.[15]

Marci illustrates the importance of the function of position in the development of the multiform organs from a uniform substratum by another comparison drawn from the study of optics. As the lens breaks up the rays of the single source of light into multiform images, so also here is the production of multiplicity from the single and uniform, the restriction of the infinite to the finite. The development of something distinct from the "confusa species" is also

[14] In spite of the regular progress of development in general an important organ such as the heart is completed before the whole. The "punctum saliens" of a bird's egg can be seen as early as the second or third day of incubation, "velut sanguinis concreti gutta." The tempo of the development varies according to the distinctness of the image projected from the centre.

[15] The whole conception foreshadows the modern so-called "Feldtheorie," as established by the work of Gurwitsch, Spemann, Mangold, Weiss, Joseph and Dorothea Needham, Waddington. See the review of Waddington in *Science Progress*, No. 114, Oct., 1934, p. 336.

comparable with the action of the lens, which " virtute refractionis," separates individual rays out of a bundle of rays.

The process of development commences when the anima of the parents, by imitation of its own species, draws the outline of the child. Then the anima operates as the plastic force according to the commands of the species which it has itself conceived. The process resembles that of perception which is nothing more than a kind of photography caused by the adaptation of the brain to the object by means of the impression of the senses. Thus the soul is her own ape.

The force of development operates from the mathematical centre of the fetal body. This point is fixed in definite relation to the centre of the parent body. As light gives off rays without itself decreasing, as the cornea outlines an image both as a whole and as a bundle of rays, the virtue in the centre loses nothing of its power and importance to the whole when it assists the parts in their development. It can be regarded as representing both " implicatio " and " explicatio."

The developing force in its activity resembles the process of imagination, but in its essence it should never be compared with processes, such as imagination, which are entirely connected with the brain. The brain does not penetrate to the interior of things, it can never see anything more than the surface. Even if we could split up everything into the smallest parts we should only see their surfaces, although these parts might be infinite in number.[16] For size, position, union of the whole with its parts, internal factors, are essentially decisive, such as the anima which " efficienter " forms the parts and the species which " exemplariter " designs them. External influences, however, can shape many things, as is seen in the case of deformed Chinese feet, artificially produced macrocephaly, trained plants.

Further, a conception derived from the study of Optics and applied to the whole process of development explains the occurrence of *deformities*. If the envelope surrounding the centre of the

[16] " Et tametsi interna viscera omnesque abditae partes detegantur, non tamen praeter superficies coloratas alia videremus, praeter-quam quod sectio partium numero infinitarum nunquam terminaretur." Even when the surface of the parts is very small, invisible channels in the internal parts have developed, by means of which the internal force distributes nourishment.

embryo is not uniformly opaque, the rays proceeding from the central point and transmitting the species may be abnormally refracted. If reflexion occurs, a limb belonging to the periphery may be pushed unduly near to the centre. Fundamental deformities, such as multiplicity of the whole fetal body, are said to be due to the multiplication of the centre of formation, i. e., the heart. On the other hand, abnormal refraction at the surface may possibly be the cause of an increased number of various limbs, the existence of more than the usual extremities, two heads projecting from the shoulders or additional heads springing from the abdomen. The latter abnormality is regarded as the result of a deflexion of the rays near the centre of the plan.

A particular form of refraction and deflexion of the rays proceeding from the centre and meeting with a medium which is too thin, causes giant growth. The reports of the enormous size of the ancients seem to Marci to be fables, since these reports are contradicted by the normal size of the mummies which have been discovered.

Thus the fundamental similarities in the majority of deformities become comprehensible, since in their formation they all follow the same laws of refraction. Irregularities of the surface, however, generally arise when the seed does not change at the right time into a homogeneous mass. For originally it consists of numerous transparent glass-like balls into which it has been changed through the effervescence which occurs during ejaculation. Later the enclosed spirits burst the walls, changing the seed into a homogeneous mass.

Deformities also occur as the result of external influence on the pregnant mother (birth-marks) or on account of the hereditary structure. Thus the thought of an apple by the pregnant mother can lead to the formation of an apple-like excrescence on the child. But naturally it is only the shape of an apple which is here imitated. The material composition of the excrescence is the same as that of the whole individual. A foreign species has forced the soul to work up the same material substratum into an abnormal formation. In normal development there is agreement between the working and commanding forces, the latter being the outline designed by the species. Once the process of development has begun it continues towards its goal without intermission.

The speculative embryology of Marcus Marci quoted here may be regarded as a typical product of the XVIIth century. It combines Aristotelian principles not only with mechanistic and physical explanations of the life processes but also with elements of mystic philosophy.

Light is the measure and model of development, the light-like unit, situated in the centre of the body, i. e., in the heart, governs the formation of the various organs. The messengers which carry its commands and transmit its activity to the surfaces where the parts are being formed, are like rays of light and subject to the same law of refraction. The transition from a confused species to the distinct formation, the termination of the infinite, may be compared with the separation of a single ray from a bundle of rays. Consequently deformities depend upon abnormal refraction of the rays due to irregularities of the surface. All this, however, is nothing more than an attempt to give to the general metaphysics of light a foundation of physical principles and to apply these laws to the fundamental processes of animate nature.

That Marci actually sees these processes under the universal aspect of a " Panaugia " is evident from his extensive dependence upon the physiological and pathological doctrines of Paracelsus and van Helmont, whose conception of the " Archeus " he accepts.[17] In van Helmont's opinion, light in its capacity of intermediary between world and individual, between infinite unity and multiplicity, is the symbol of the seedlike origin of all things in the world in general, and particularly in the moment of the origin of new life.

[17] Accordingly *Marci* in his paper on epilepsy (" Liturgia mentis ") suggests a particular " gaseous " species from outside like a poison, and not a primary disturbance of the humours, to be the cause of this disease. The poison operates by means of humours and vapors which are exuded and, like rays, transmit the effect. Such rays also cause fever. Poisoning signifies the reception of an idea transmitted by the poison. Either this idea causes death as the result of the extinction of the flame of life or the corruption of the seminal idea of the body, or the functions are damaged on account of the transplantation of the idea of the poison. The autonomy of the archeus is abolished by the penetration of the foreign idea. The same " magnetic " influence, that is to say, one connected with the imagination of a species, which causes an evil, also cures it. Human saliva which is able to cure snake bite when the wound is sucked, receives its curative virtue from the imagination of the healer, who does not derive this power from himself, even though such properties are hereditary. (Πᾶν ἐν πάντων. *Philosophia vetus vestituta* (Prague, 1662), Pars V: " De statu hominis praeter naturam ").

In the semen the archeus becomes "luminosus." Endowment with the "Lumen formale et vitale" by the Creator alone permits the existence of the living entity. All that is active pertains to light, both the action of poison and the command of the organism in its entirety over the subordinate organs.[18] Marci's estimation of the "hermetic" wisdom of Mose, which according to him greatly exceeded the knowledge of the Greeks who knew no more than four elements, corresponds to the view of Paracelsus and Helmont. Marci rejects the idea of the influence of demons, and, like Helmont, declares magic effects to be "effectus naturales" — notwithstanding the fact that magic can neither be taught nor learned and requires a peculiar kind of "saturnine personality."

In many respects Marci *dis*agrees with Helmont, in his aspiration for mechanistic pseudo-explanation and simplification. Thus his hypotheses bear certain resemblances in many ways to those of Descartes and de le Boe. This also applies to his schematic valuation of the flame-like character of the life principle,[19] as well as to his one-sided Aristotelian emphasis of the heart. On the whole, however, his dependence on van Helmont and the close connection of the metaphysical and mystical view with the science of optics are his most noteworthy characteristics.

(*To be Continued*)

[18] See my *I. B. van Helmont, loc. cit.*, pp. 22, 24, and my *Helmont, Leibniz, Stahl, loc. cit.*, pp. 26, 33 (on *Comenius*).

[19] He explains disease quite naïvely as being due to disturbance of the upward or downward movement of the *life flame*. Both types of disturbance can be classified according to the increase or decrease in these movements. The cause of disease is to be found in the material feeding the flame or in the flame itself. The fire and flame of life are distributed over the body, although there is a "focus perennis" in the heart. The persistence of that focus explains the reanimation of the apparently dead. In mountain sickness, e. g., a special "species" causes the sense of fear. Then the innate heat becomes too great on account of the accumulation of smoke and the flame of life is dimmed. A large, rapid, strong pulse shows the necessity for coolness and ventilation. Thus tremors, chattering teeth and bristling hair occur. The limbs become very cold, since too much of the spiritus returns to the heart. On account of the cold the nerves cause alternating contraction and relaxation in the innervated parts of the body. Compare the doctrine of Fr. Bacon, *Hist. de ventis, loc. cit.*, p. 167 — according to which like a flame the spirit of the body consumes its life and finally dries up the engine of the body entirely. See Croll, *Basil. chym., loc. cit.*, p. 105: As laying wood on the hearth preserves the fire, suitable arcana and remedies preserve the flame of life.

MEDICO-HISTORICAL ACTIVITIES IN THE UNITED STATES

BALTIMORE, MARYLAND

JOHNS HOPKINS UNIVERSITY

Institute of the History of Medicine

The eleventh annual meeting of the History of Science Society was held in Washington, D. C., on December 28th and 29th. All the members of the Institute attended the meeting, and Dr. John Rathbone Oliver presented a paper on "Greek Medicine in its Relation to Greek Civilization." Dr. Sigerist was elected second Vice-President of the Society, delegate to the American Council of Learned Societies, and chairman of a committee for the publication of a glossary of mediaeval Latin medical and scientific terms.

Dr. Sanford V. Larkey, of the University of California, was at the Institute from December 22nd to 26th, and came back on January 5th. In the evening of January 5th, a dinner was given in his honor at the 16 W. Hamilton Street Club, which was attended by the medical history group, and the members of the English department. Dr. Larkey gave a very fascinating talk on English Scientific Prose in the 16th Century, which was followed by a lively discussion.

On January 9th, Dr. Sigerist delivered the John T. Hodgen Lecture at the meeting of the Surgical Society in St. Louis, Missouri, on the subject, "Surgery at the Time of the Introduction of Antisepsis." While in St. Louis Dr. Sigerist examined the Beaumont manuscripts preserved at Washington University, as he intends to publish the two note-books of Beaumont.

On January 14-17, Dr. Sigerist was in New Haven, and delivered three lectures on the Social Aspects of Medicine, at Yale University.

The Washington University Medical School in St. Louis, Missouri, presented the Institute with a splendid collection of 26 photographs reproducing portraits and manuscripts of Beaumont.

Reprints of "An Essay on the External Use of Water, by Tobias Smollett," edited, with introduction and notes, by Claude E. Jones, in the first number of volume III of this Bulletin, have been bound in boards, and can be obtained from The Johns Hopkins Press at the price of $1.00.

The Johns Hopkins Medical History Club

The second meeting of the year was held on January 21, 1935, in the Institute of the History of Medicine. The speakers of the evening were

members of the School of Hygiene and Public Health. The following papers were read:

The Cultivation of Longevity.....Dr. Raymond Pearl

Some Aspects of the History of Yellow Fever
Dr. Wade Hampton Frost

Landmarks in Nutritional Research.....Dr. E. V. McCollum

The following exhibits were displayed:

Dr. Raymond Pearl's collection of books on Longevity.

Books on the History of Hygiene, purchased by Sir Arthur Newsholme.

Recently published facsimiles of drawings by Leonardo da Vinci.

New publications on the History of Medicine, purchased by the Institute.

New additions to the collections of the Institute.

H. E. S.